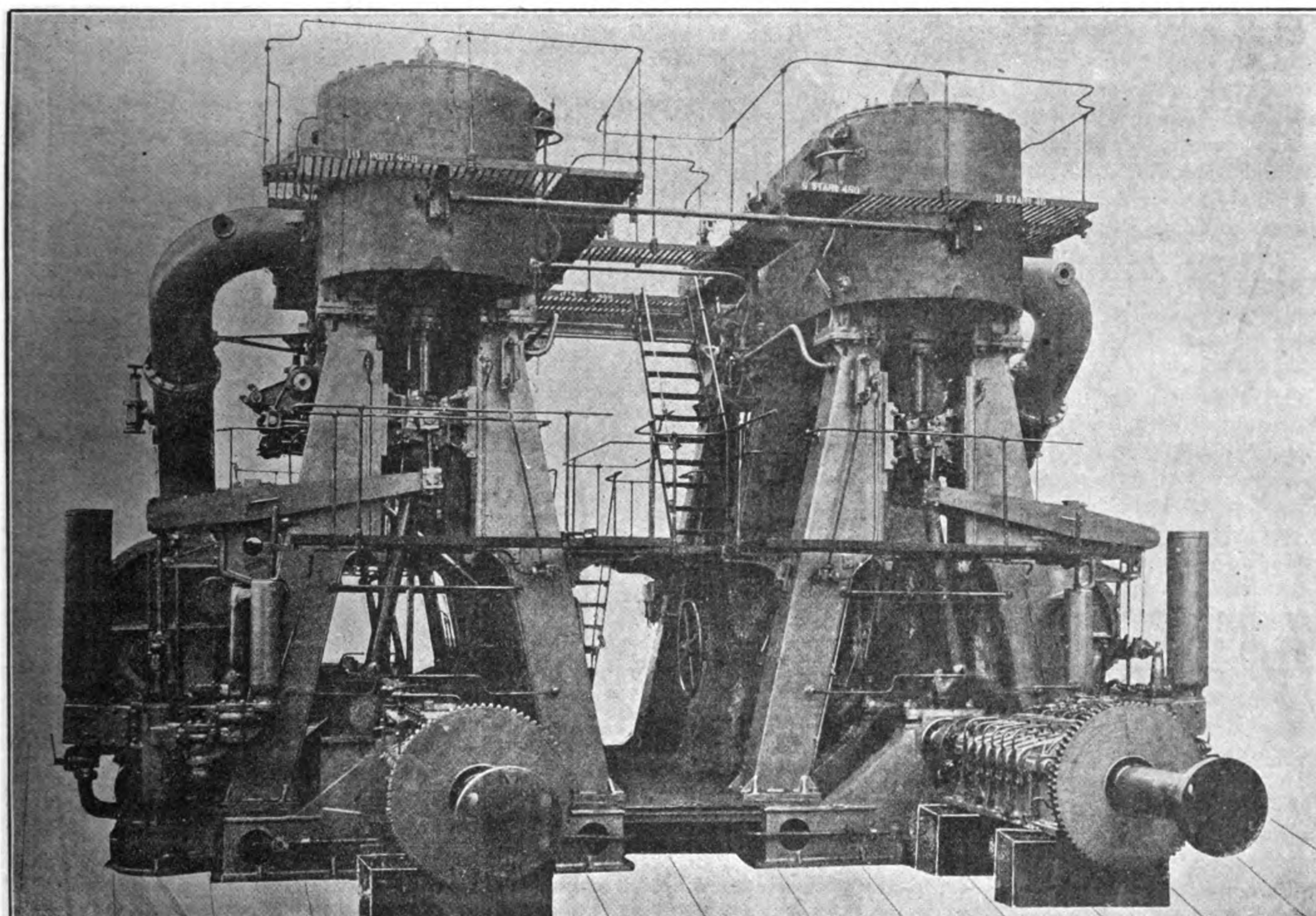
THE MARINE REVIEW

VOL. XXXVI. CLEVELAND, AUGUST 1, 1907. NEW YORK No. 5

STEAMERS QUILLOTA AND QUILPUE.

The Pacific Steam Navigation Co. have added to their fleet since June of last year nine steamers, totaling 49,280 tons, and have in course of construction at the present time five more vessels, totaling 30,500 tons, making an aggregate of 79,280 tons. These vessels range from 11,500 tons down to 3,669 tons. It was in 1840 that, contemporaneously with the establishment of steam communication between England and Colon, on the Atlantic side of the Isthmus of Panama, a charter was granted to the Pacific Steam Navigation Co. A monthly service of paddle-wheel steamers was then inaugurated, the itinerary embracing all the then principal ports between Valparaiso and Panama.



TRIPLE-EXPANSION ENGINES OF THE PACIFIC STEAM NAVIGATION CO.'S TWIN-SCREW STEAMER QUILPUE.

The venture, however, proved anything but profitable to the promoters; but in spite of apparently insurmountable difficulties the obstacles, one after another, were overcome. The opening of the railroad across the isthmus further gave an impetus to the trade in all the finer products—gold and silver ores, copper, cocoa, etc.—from Ecuador, Peru, and Chili, these countries taking in return large quantities of fine goods, railway material, machinery, etc. Other produce, however, such as sugar from Peru, and cereals from Chili, found its way home by sailing

vessel via Cape Horn; and thus, until the year 1868, the sailor had a monopoly of the all-sea trade to and from the Pacific.

In that year, however, the Pacific Steam Navigation Co. commenced the service of mail and passenger steamers through the Straits of Magellan from Liverpool, increasing the regular sailings from one per month to one per fortnight in 1870, and from a fortnightly to a weekly service, with an extension of the line to Calao, under a mail contract with the British government, in 1873. To accomplish this later undertaking a fleet of twenty-one large ocean-going steamers was provided, itinerary embracing regular calls at French, Spanish, Portuguese, Brazilian and River Plate ports. In consequence, however, of a considerable falling-off in the trade to and from the West Coast, the weekly service of mail steamers was abandoned, and the fortnightly sailing resumed; and this is the arrangement which now prevails.

In addition to the mail service, which embraces also calls at the Falkland Islands, the company despatches a steamer once a fortnight from Glasgow and Liverpool to Punta Arenas, and all the principal West Coast ports as far north as Eten. These extra steamers take second-class passengers and cargo for, and call alternately at, Rio Janeiro and at the Argentine Coast ports of Bahia Blanca and Port Madryn.

The company's fleet now consists of 53 steamers, with an aggregate tonnage of 197,471 tons, the latest additions being the Ortega, Oronsa, and Oriana, of 8,000 tons each, and having accommodation for 400 cabin and 600 third-class passengers. The West Coast service proper, i. e., from Port Montt in the south to Panama in the north, is maintained by a fleet of 29 screw steamers of the modern type, including the twin-screw steamer Panama, with sister-ships named Victoria, Mexico and California, of 401 ft. 2 in. in length, 52 ft. 3 in. in beam, and 33 ft. 7 in. in depth, of 6,000 tons register, and with the exceptionally fine accommodation on the upper decks for large numbers of passengers.

The new twin-screw steamers Quillota and Quilpue, which have just been completed at the naval construction Works at Dalmuir of Messrs. William Beardmore & Co., have been specially designed for the company's passenger and mail service in the West Coast of South America, and represents a type of steamer admirably suited for such work. Indeed, in the building and finishing of these vessels Messrs. Beardmore show that they aim at a high standard of excellence, both as regards workmanship and materials.

The principal dimensions of the vessels are as follows: Length between perpendiculars, 360 ft.; breadth, molded, to upper deck, 25 ft.; and to spar deck, 32 ft. 9 in. The gross tonnage is 3,669 tons in the case of the Quilpue, and 3,673 tons in the Quillota, with a net tonnage of about 1,960 tons. The dead-weight carrying capacity is about 3,400 tons on Lloyds summer freeboard. A double bottom, for the storage of fresh water and the carriage of water ballast, is fitted all fore and aft. The vessels have been built under special survey to Lloyd's highest class for both hull and machinery, and are completed and equipped in accordance with board of trade requirements for passenger service.

In view of the fact that the vessels are intended for service in a hot climate, the first-class accommodation has been placed in deck houses on top of the spar-deck. Large two-berth state-rooms for about eighty passengers are fitted to give the maximum of free air. Over this deck-house is a boat or platform deck for a promenade. The dining saloon is also situated in a house on the spar deck, and is an apartment well lighted and ventilated and capable of seating the whole of the first-class passengers. The social hall is placed immediately above the dining-saloon, and has a large well in the center, with a skylight which gives light and air to both social hall and dining-saloon.

Portable "standee" berths are supplied for about fifty steerage passengers for erection on the poop-deck, and on the main deck between the poop and forecastle similar berths for a large number of steerage passengers may be erected. The sides of the ship between the top of the bulwark and the spar-deck are left open for this distance amidships, ensuring the best of ventilation. The view of the vessel does not show this portion open, as it had been temporarily boarded up for the voyage to South America.

Special attention has been paid throughout to the sanitary, lighting and ventilating arrangements, so as to provide against the climatic conditions and for the trade. Side hatches are fitted for the forward and after holds, and one large center hatch to the main

150-TON ELECTRIC DERRICK CRANE.

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hold, with large winches, derricks and rapid cargo-handling appliances to meet special local requirements on the West Coast of South America.

The propelling machinery consists of two sets of vertical triple-expansion engines, with cylinders 20 in., 33 in., and 55 in. in diameter respectively and of 3 ft. 4 in. stroke; steam is supplied from four single-ended boilers, each 16 ft. in diameter and 10 ft. 6 in. long. The working pressure is 190 lb. per square inch.

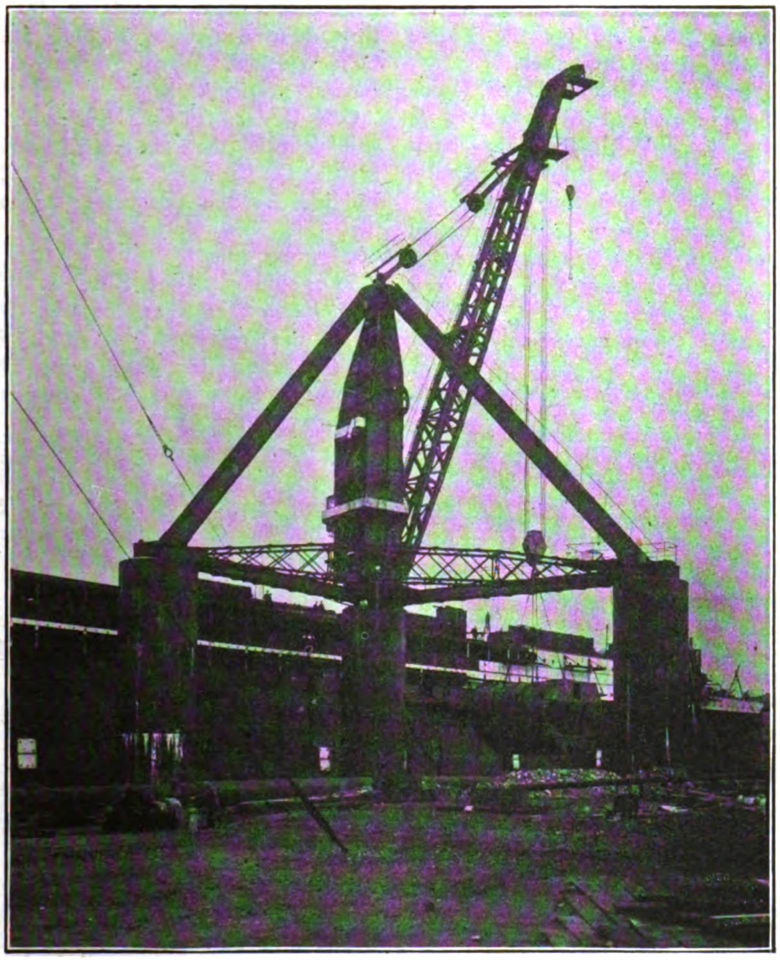
During the trials of the vessels each maintained a mean speed of nearly 15 knots on the measured mile, and the machinery worked satisfactorily in all respects throughout the whole of the trials, which included a run from the Clyde to Liverpool.

A notable feature was the time taken to build the ships. The Quillota was handed over in 246 working days, and the Quilpue in 319 days from the placing of the order; a performance which indicates the facilities for rapid constructional work available at the works of the builders.—*Engineering*.

Secretary of Commerce and Labor Straus is engaged in making a tour of the Pacific coast.

150-TON ELECTRIC DERRICK CRANE.

What is claimed by its makers to be the largest derrick crane in the world has recently been supplied and erected complete by Messrs. Cowans Sheldon & Co., Ltd., of Carlisle, at the Clydebank ship building yard of Messrs. John Brown & Co., Ltd. The crane is driven by electric power, and its massive proportions may be gathered from the following description and the illustrations here given. Radius of jib for 150-ton loads, 65 ft.; maximum radius for 30-ton loads, 120 ft.; minimum radius for all loads, 27 ft.; height of jib above quay at 65 ft. radius, 176 ft.; distance from quay level to top of mast, 120 ft.; centers of sleepers, 64 ft.; height of sleepers above quay, 44 ft. The crane is mounted on three steel cylinders, 14 ft. diameter, which were sunk about 60 ft. below the quay level, and afterwards filled with concrete. The jib and diagonal sleeper are of lattice construction, the remainder of the framing being built up of steel plates and angles. There are two independent sets of lifting gear, one for loads up to 150 tons, and the other for loads up to 30 tons. These two sets of lifting gears, as well as the slewing and derricking gear, are each driven by a separate motor. The four motors are series-wound, and are each designed to develop 65 brake H. P. The whole of the electrical equipment was made by the Lancashire Dynamo & Motor Co., Ltd., Manchester. The various motions are worked at the following speeds: Lifting 150 tons at 4 ft. per minute, lifting 75 tons at 8 ft. per minute, lifting 30 tons at 20 ft. per minute, lifting light loads at 90 ft. per minute, revolving 150 tons at one revolution in 6 minutes, revolving light loads one revolution in 3 minutes, derricking 150 tons at 5 ft. per minute. The whole of the gear is of steel, and, with the exception of the barrel wheels and rack, the teeth are machine cut. Automatic brakes have been provided on each motion, those for lifting and revolving being of the solenoid type, and the one on the derricking gear of the Weston type. Both of the illustrations show the crane putting boilers on the Cunard leviathan, Lusitania, now completing at Clydebank.



150-TON ELECTRIC DERRICK CRANE.

NEW CANADIAN STEAMER FOR THE LAKES.

The Canadian Pacific co.'s screw steamer Assiniboia was launched on Tuesday, June 25, from the yard of the Fairfield Shipbuilding and Engineering Co., at Glasgow. The Assiniboia is 348 ft. long, and has a tonnage of 4,300. The vessel, which will be sumptuously furnished, will be ready for service on the great lakes in August. The Assiniboia will require to be cut in two before she can pass through the American canals on her way to her destination. Before the launch took place the zig-zag line that marked the division was distinctly visible.

The Austro-Hungarian government have contracted with Messrs. Yarrow and Co. of Poplar and Glasgow, for the construction of two exceptionally high-speed shallow-draught gunboats, propelled by internal combustion engines. These vessels are to be in all essential particulars similar to Mercury II, which was purchased by the British Admiralty last year, and on board which, it will be remembered, the King and Queen took a trip during Cowes week.

Admiral John Pearse Maclear, retired, of the British navy, recently suffered an attack of heart failure caused by the heat, while staying at Niagara Falls, N. Y. dying instantly.

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WORK IN COAST YARDS

J. Lindstrom, Aberdeen, Wash., is completing the construction of three large barges for Hale & Kern of Portland, Ore.

The New York & Porto Rico Line steamer Carolina was recently sent to the Shooters Island Ship Yard for an extensive overhaul.

The Kelley-Spear Co., Bath, Me., have recently contracted to build a covered lighter for the Terminal Warehouse Co., New York.

Peter Hagan & Co., Philadelphia, have recently launched a 600-ton barge for the coastwise trade from their Camden, N. J., yard.

The Morse Machine Shop at Bath, Me., which was owned by the Eastern Steamship Co., of Boston, was burned lately, involving a loss of about $3,000.

The ship building and repair business heretofore conducted by John M. Brooks at East Boston, Mass., has been aquired by Samuel W. K. Brooks.

Oliver Reeder & Co., Baltimore, Md., are to build a 70-ft. tug for Mr. Charles Lewis of Baltimore. The machinery will be supplied by the E. J. Codd Co. of that city.

The steamer Allianca, of the Panama Railroad Co.'s line between New York and the isthmus, has recently been repaired at the Cramp yard, Philadelphia.

Parmelee & Sons, Morgan City, La., recently launched an 80-ft. steamer for the passenger and mail service at Belize, Honduras. The cost of the vessel was $31,000.

The Mobile Marine Ways, Mobile, Ala., are rebuilding the government dredge boat Cape Charles. She is to be equipped with new machinery costing about $30,000.

The steamer J. Marhoffer, which met with a serious accident on her first trip up the coast, was at the Lindstrom yard at Aberdeen, Wash., recently for repairs.

The four-masted schooner which is under construction by George A. Gilchrist at Belfast, Me., for Pendleton Bros. of Isleboro, Me., is to be named Fields S. Pendleton.

The Heath Ship Yard, Tacoma, Wash., has recently been awarded a contract for a tug for the Ketchikan Power Co., of Ketchikan, Alaska. This tug will be 73 by 18 ft.

The Moran Co., Seattle, Wash., have completed the general repairing and overhauling of the tugs Wanderer, Sea Lion, Prosper, Wyadda and Bahada of the Puget Sound Co.'s fleet.

The three-masted schooner now in course of construction at the Bowker Ship Yard, Phippsburg, Me., is to be named Horace M. Bickford and will be ready for launching Oct. 1.

The tug Marion, built at the Heath Ship Yard, Tacoma, Wash., was recently completed and has left on her voyage for the north. She is owned by the Norway Packing Co.

The Matthews Ship Building Co., Hoquiam, Wash., are busy with the construction of the steamers Shasta and Saginaw, building for the Pacific Lumber Co. of San Francisco.

The steel tug Mitchell Davis, owned by the Maryland Construction & Dredging Co., Baltimore, has been thoroughly overhauled by the Pusey & Jones Co., Wilmington, Del.

The Greenport Basin & Construction Co., Greenport, N. Y., has been awarded contract for the construction of a new steamer for Lowndes & Mills, work on which is to be begun immediately.

The Maryland, Virginia & Delaware R. R. Co.'s steamer Middlesex has been in dry dock at the yard of the Skinner Ship Building & Dry Dock Co., Baltimore, for repairs.

The Spedden Ship Building Co., Baltimore, Md., has recently given the Maryland Pilot Association steamer Pilot her annual overhauling, including repairs to her engines and boilers.

The Harlan & Hollingsworth Corp., Wilmington, Del., will have the second of the three ferryboats which it is building for the 39th Street ferry, New York, ready for delivery about Aug. 7.

W. A. Boole & Son, Oakland, Cal., have begun the construction of an oil barge for the Standard Oil Co. which is to have a capacity of 2,800 barrels of bulk oil, to be carried in steel tanks.

The Pusey & Jones Co., Wilmington, Del., has recently completed the revenue cutter Pamlico and she has been fitted out at Baltimore and sent to her station at Arundel Cove, North Carolina.

The Herreshoff Mfg. Co., Bristol, R. I., is to construct a ferryboat for the navy department to cost about $40,000 and which will run between the Newport, R. I., torpedo station and Goat Island.

The Maryland Steel Co., Sparrows Point, Md., was the only bidder for the construction of a seagoing tug for the navy department to be known as revenue cutter No. 18 and to be completed August 30, 1908.

The steamship Ohio, White Star Steamship Co., Seattle, Wash., owners, has been put in dry dock at Quartermaster Harbor to make repairs necessitated by her recent accident in the north when she was in collision with submerged ice.

The N. Y., N. H. & H. R. R. Co.'s steamer City of Lowell collided with a car float in the East River recently and had to be sent to dry dock at the yard of the Tietjen & Lang Co., Hoboken, N. J.

The tug Tyee, one of the largest of the fleet of the Puget Sound Tug Boat Co.'s fleet, was docked by the Hall Bros. Marine Railway & Ship Building Co., Winslow, Wash., recently for a general overhaul.

Cobb-Butler & Co., Rockland, Me., will launch the six-masted schooner Mattie B. Crowley, Aug. 24. She is building for the Coastwise Transportation Co., New York, and is of about 3,000 gross tons.

The ship yard of King & Winge, now located at West Seattle, Wash., is to be removed to Aliki Point, Wash., where the firm owns 800 ft. of water front and will construct a first-class ship yard.

The first four-masted schooner which was ever built at Portland, Me., will be launched from the yard of the Casco Ship Building Co. in that city August 15. The vessel is 170 ft. long, 37½ ft. beam and 13½ ft. deep.

The tank steamer Winifred, owned by the Guffey Petroleum Co., Pittsburg, broke her shaft in the gulf some time ago and was towed to New York and docked at the Erie Basin dry dock of the J. N. Robins Co.

The Pusey & Jones Co., Wilmington, Del., has completed the repairs to the United States quarantine steamer Neptune. The Neptune was originally built at this yard and is one of the finest tugs in the quarantine department.

The Old Bay Line steamer Raleigh was recently given a thorough overhauling, including the installation of new steam steering gear and other machinery, at the yard of the Maryland Steel Co., Sparrows Point, Md.

The auxiliary fishing schooner Bessie M. Dugan, built by W. L. Adams, Bath, Me., for Trepethen & Dugan, Portland, Me., was launched recently. She is 75 long, 17 ft. beam and is equipped with a 64-H. P. gasoline engine.

The Maryland Steel Co., Sparrows Point, Md., has turned the passenger, mail and express steamer Maryland over to her owners, the New York, Philadelphia & Norfolk railroad. She is to run between Norfolk and Cape Charles City.

The propeller Nanticoke, owned by Stevens & Condit, which was damaged

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by fire some months ago, is at the Essex Street plant of the Brown Dry Dock Co., Jersey City, N. J., completing her transformation into an open-decked steam lighter.

Bertelsen & Petersen of East Boston, Mass., have been awarded contract by the Ross Towboat Co. for the construction of a harbor and bay tug about 75 ft. in length and they will also build a tug for the Merrimac Towing Co. of Newburyport, Mass.

Alexander Miller & Bro. of Jersey City are progressing well with their work on two of the fireboats for the city of New York and they are expected to be ready for delivery in about three months. The third of the fireboats is also well under way.

The Bertelson & Petersen Engineering Co., East Boston, Mass., suffered the loss of its machine shop by fire July 19. The company will immediately replace the structure with one of fireproof construction and of modern design. Up-to-date fittings will also be installed.

The Standard Oil Co.'s tank steamer City of Everett was being given repairs recently at the company's yards at Long Island City. She is an oil burner but it is reported that she is to be altered for coal burning before receiving her new boilers.

The Atlantic Works, East Boston, Mass., has been awarded contract by the Nantasket Beach Steamboat Co., Boston, for a steamer for service in Boston harbor, to be 180 ft. long, 31 ft. beam and 12½ ft. deep. She will be equipped with triple-expansion engines and Scotch boilers.

Work has been begun by the New York Ship Building Co., Camden, N. J., upon the oil tank steamer which it is to build for the Gulf Refining Co., and which will be named Oklahoma. This vessel is to be 440 by 55 by 30 ft. and will be completed next February.

The United States government has awarded a contract to the Merrill-Stevens Co., Jacksonville, Fla., for keeping all government vessels of the Savannah district in repair. Among these are the dredge Savannah, and several snag boats, launches and dredges.

The Heffernan Engine Works, Seattle, Wash., has taken over the dry dock of the old Puget Sound Dry Dock Co. at Quartermaster Harbor and will eventually remove it to Seattle where it will enable the company to handle some of the big work of the Pacific coast.

The Dickie ship yard at Raymond, Wash., which is considered one of the most complete for the building of wooden vessels on the Pacific coast, is engaged in the construction of two steam schooners for the Sudden & Christensen Co. of San Francisco, which will carry 800,000 ft. of lumber each.

The Moran Co., Seattle, Wash., is to build a steam schooner for the Northwestern Steamship Co., of Seattle, to be a duplicate of the Seward, launched at that yard recently. The vessel is to be ready for operation by the opening of navigation in the spring.

The steam schooner Bee, building at the Lindstrom yards at Aberdeen, Wash., for Fred Linderman of San Francisco, was launched June 24. The Bee is 13 ft. deep, 38 ft. beam and 187 ft. over all. Her machinery is to be installed at Portland. The total cost of the Bee is about $90,000.

The Maryland Steel Co., Sparrows Point, Md., launched the Old Bay line steamer Florida, July 24. When the Florida goes into commission she will be the largest passenger steamer operating in local service south of New York. She is 306 ft. long, 56 ft. beam and 19 ft. depth of hold.

Percy & Small, Bath, Me., will have the four-masted schooner Governor Brooks, which they are building for their own fleet, ready for launching in October. This vessel is of about 2,600 tons burden and is named for the governor of Wyoming, who is expected to be present at her launching.

The lighthouse board has awarded contract to the New York Ship Building Co., Camden, N. J., for the construction of lightships Nos. 90, 91, 92 and 93, on its bid of $222,000 for two vessels, or with Scotch boilers $224,000, or for four vessels $438,000, or with Scotch boilers $442,000.

Smith & Rhuland, Lunenburg, N. S., are getting out the timbers for a vessel for W. C. Smith & Co., which will be 96 ft. long, 29 ft. beam and 10 ft. 9 in. in depth. The tern schooner which is under construction at this yard for Capt. Howard Hebb and others is about one-half completed.

Work has been started at the yard of John W. Dickie & Son, Raymond, Wash., on a large steam schooner, 205 ft. long, and 40 ft. beam, for I. J. Harmon of San Francisco, Cal. The vessel will have a lumber-carrying capacity of 1,000,000 feet and will be engaged in the coastwise trade.

The five-masted schooner Elvira Hall, building for the Gilbert Transportation Co., Mystic, Conn., at that place will probably be launched about the middle of August. When launched the vessel will be ready for sea. She has been built so that she can be fitted with motive power with comparative ease.

The firm of Clooney Bros. of Lake Charles, La., have announced their intention to erect a ship yard at Orange, Tex., which will be the most thoroughly equipped industry of its kind in Texas or Louisiana. The yard will be located on the Sabine river and will make a total of three yards at Orange.

The new steel passenger propeller Boothbay which was built by the Neafie & Levy Ship & Engine Building Co., Philadelphia, for the Eastern Steamship Co. of Boston, has been completed and has entered upon her service between Bath and Boothbay. She is 126 ft. long, 33 ft. beam and 10 ft. depth of hold.

The Maryland, Virginia & Delaware R. R. Co.'s steamer Northumberland recently underwent thorough repairs to her machinery at the plant of the Maryland Steel Co., Sparrows' Point, Md., and was then taken to the Booz Bros., Baltimore, Md., for cleaning and painting before resuming her service.

The new steel passenger propeller Seagate, which was built at the yard of the T. S. Marvel Ship Building Co., Newburgh, N. Y., for Drake Bros., is now in service between Battery Landing, New York, the Cresent Club and Seagate, Coney Island. The Seagate is a handsome craft capable of accommodating 600 passengers.

The Newport News Ship Building & Dry Dock Co., Newport News, Va., launched the first of the two steel car floats which it is building for the New York Central & Hudson River Railroad Co., July 19. These floats are for service in New York Harbor and are each 225 ft. in length. The second will be ready for launching early this month.

Diebert Bros., Elkton, Md., have been awarded contract for the construction of a large barge for the P. Dougherty Co. of Baltimore. The vessel is to be 215 ft. in length, 35 ft. beam and have a capacity for carrying 2,000 tons. The barge will be sea-going and will be equipped with sails and gasoline engines for motive power.

The new tug boat which is under construction for the Mutual Co., of New York, by Robert Palmer & Son, Noank, Conn., is to be ready for delivery Sept. 15. The dimensions of the tug are: Length, 100 ft.; beam, 23 ft., and depth of hold, 11 ft. The engines are to be 16, 12 and 24 and steam pressure up to 350 pounds will be allowed the boiler.

The Cambridge Mfg. Co., Cambridge, Md., has recently completed the gasoline barge Princess for Capt. John C. Reed. She will be used for Bay freighting and in the truck trade, and is fitted with a 125-H. P. gasoline engine in-

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stalled by the Harris Engine Co., of Baltimore. The Princess is 100 ft. long, 23 ft. beam and 6½ ft. deep, and has a capacity of 125 tons.

The J. N. Robins Co., Erie Basin, South Brooklyn, New York, is engaged in the rebuilding of the New England Steamship Co.'s steamer Plymouth, which was burned last year. She is to be equipped with every possible precaution against fire including a sprinkler system and fire bulkheads, which will insure against the repetition of any such disaster as previously befell her.

The steam yacht Cavalier, building for Mr. Charles E. Proctor, of the New York Yacht Club, was launched at the yard of the Robert Jacob Co., at City Island, N. Y., recently. The Cavalier is 135 ft. by 16 ft. by 4 ft. 6 in. and is fitted with Sullivan engines and Roberts boilers. The Cavalier was designed by Swasey, Raymond & Paige, of Boston.

The contract for repairing the steamer Northwestern was awarded to the British Columbia Dry Dock Co., Esquimault, B. C., the bid from the Heffernan Engine Works, Seattle, Wash., of $66,425 and that from the Sound Shipping Co. of $52,000 being higher than that of the successful company. Good progress is being made on the work.

James Shewan & Son, New York, have been awarded a contract by the war department to make the repairs to the dredge boat General Abbott, after which she will be employed by the United States army engineers in charge of the improvements being made in the Southwest Pass at the mouth of the Mississippi. The repairs amount to $25,000.

A steamer now on the ways at the J. Lindstrom yards, Aberdeen, Wash., and which was ordered by the Beadle Bros. of San Francisco, will be launched about August 10. The steamer has, however, been sold to a party of coast capitalists and will be christened Grays Harbor. Her architecture is similar to many of the steam schooners built at this yard.

The hull of the steamer William H. Murphy, which was recently launched at the yard of the Matthews Ship Building Co., Hoquiam, Wash., has been completed and started on a maiden voyage in tow of the sister ship Temple E. Dorr carrying lumber to Aberdeen. She will then be towed to San Francisco where her machinery will be installed.

The Atlantic Works, East Boston, Mass., recently completed an extensive job of repairing on the floating hospital steamer of that city, having torn away the entire upper works of the vessel and installed a boiler, the necessary machinery and a refrigerating plant capable of making 20 tons of ice a day. The vessel left on her initial trip July 2.

The Merrill-Stevens Co., Jacksonville, Fla., has recently overhauled the Spanish bark Habana, which is the craft that was abandoned by her crew off Fernandina and towed into Jacksonville by the Jacksonville Towing & Wrecking Co., which afterward purchased her. It is probable that she will fly the Cuban flag after being placed in commission.

Robert Palmer & Son Ship Building & Marine Railway Co., Noank, Conn., is building a new tugboat for the Mutual Co., New York. She will be 100 ft. long, 23 ft. beam and 11 ft. depth of hold. The engine will be compound, 16 and 32 by 24 in. Steam is to be supplied by a steel boiler allowed 150 lbs. pressure. The vessel is to be completed by Sept. 15.

The Hall Bros. Marine Railway & Ship Building Co., Winslow, Wash., is building a three-masted steam schooner for George E. Billings, San Francisco. She is to be named Shna-Yak. The vessel is of wood, 195 ft. long, 39 ft. 6 in. beam and 14 ft. 6 in. deep and is of 800 tons. She is to be fitted with one engine and two 10 by 13 ft. Scotch boilers.

The keel of the steamer Tallac, building for the E. K. Wood Lumber Co., San Francisco, was laid at the Matthews Ship Yard, Hoquiam, Wash., recently. This vessel will be the smallest of the company's fleet, being 160 ft. long, 36 ft. beam and 12 ft. deep. Her lumber-carrying capacity will be about 450,000 ft. and she will run from Grays Harbor to California ports.

The Flewelling Ship Yard, Clifton, N. B., has constructed a ferry steamer for the Clifton Steamship Co., the hull of which is 65 ft. long with a breadth from guard to guard of 32 ft. and a draught of 2 ft. 6 in. The boilers are being built at New Glasgow, N. S., and the engine at West St. John. The ferry will ply between Rothesay, Clifton and Moss Glen and will be named Premier.

The Neafie & Levy Ship & Engine Building Co., Philadelphia, launched the tug Lizzie B. recently. The tug was built for the J. W. Paxson Co. Philadephia, and is 85 ft. long, 21 ft. beam and 10 ft. deep and is designed for the towing trade between Philadelphia and points on the Maurice river. She has one engine with cylinders 12½ and 25 in. by 18 in. stroke and the boiler is 10.7 by 10.6 ft.

The Milton Point Ship Yard, Rye, N. Y., at which many boats of the pleasure fleet have been built, was almost destroyed by fire July 24. Many launches and tenders belonging to New Yorkers were burned and several large racing yachts anchored near by were badly scorched. The total loss is estimated at $20,000. The fire is believed to have been of incendiary origin.

Diebert Bros., Elkton, Md., have been awarded a contract for the construction of a sea-going barge for Capt. William Henderson of Philadelphia. The barge is to be fitted with auxiliary power to discharge and load cargo and will have two masts. She will be 175 ft. long, 26 ft. wide and 13 ft. deep and will have a deadweight capacity of 1,200 tons. The barge will be employed in the coastwise coal trade.

The Fore River Ship Building Co., Quincy, Mass., has been awarded a contract for the construction of a steel tug for the New York service of the New York, New Haven & Hartford Railroad Co., which will be the fifth to be constructed by the shipbuilding firm for the railroad company. The tug will be 112 ft. long, will be fitted with the most modern towing machinery and is to be ready for service in six months.

The steamer Lawton, recently purchased from the government by the Pacific Mail Steamship Co., will be remodeled along the line of the steamer Columbia and placed in the San Francisco-Portland run in place of the Costa Rica. She is intended to be ready for service by Sept. 1. Oil burners are to be fitted and many other changes in equipment made. She will be able to accommodate 350 passengers and about 2,000 tons of freight.

The steam schooner Yellowstone was launched at Bendixsen's yard at Eureka, Cal., July 14. She is building for C. R. McCormick & Co. Her machinery is being installed at San Francisco. This yard also has under construction another steam schooner for the same company as well as one for the Holmes-Eureka Lumber Co. and the Tahoe, which is building for Matthew Turner, San Francisco, and which will shortly be completed.

The John H. Dialogue & Sons Co., Camden, N. J., is constructing a steel tug for the James McWilliams Transportation Co., New York, which is to be 135 ft. long, 25 ft. beam and 15 ft. 3 in. deep. The engine is to be a triple-expansion, 16, 30 and 41 in. cylinders, with 26-in. stroke, and was formerly in the tug Honeybrook. Steam will be supplied by a large Scotch boiler allowed 175 pounds pressure. The bunkers will hold 180 tons of coal.

Charles L. Rohde & Sons, Baltimore, Md., have nearly completed the dredge built for the Potomac Dredging Co., which is known as No.

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3. They have also nearly completed the steam hoisting derrick building for the Joseph R. Foard Co., and have been awarded a contract for an open scow for John Miller & Co., Washington, D. C., which is to be 80 ft. long, 22 ft. beam and 5½ ft. deep. The scow is for use in the brick trade on the Potomac river.

The Newport News Ship Building & Dry Dock Co., Newport News, Va., has laid the keel for the large steel freight and passenger steamship which it is to build for the Matson Navigation Co., San Francisco, Cal. The vessel is to be built in the berth recently vacated by the launching of the Mallory liner Brazos. The new steamer is to be 450 ft. long, 56 ft. beam and 30 ft. deep and will cost over $1,000,000. She will have a speed of 16 knots an hour.

The ship yard of J. H. Price at Bandon, Ore., was swept by a disastrous fire July 10 and three vessels which were under construction there were destroyed. The steam schooner Daisy was building for S. S. Freeman and the steam schooner Fifield for A. Estabrook & Co. The keel for the steam schooner Occidental had only recently been laid but she was expected to be ready for service by Oct. 1. The Occidental was building for the McKay Lumber Co. of Eureka, Cal.

The steamer Seward, building for the Northwestern Steamship Co., Seattle, Wash., by the Moran Co. of Seattle, and which was launched June 25, is to be ready to go into commission about the middle of August, if possible, and she will be sent to Nome on her maiden trip if completed in time. The Seward is of steel and was built expressly for the Alaska trade, to replace the steamship Oregon, wrecked last fall. During the winter months the steamer will be on the Valdez and Seward run.

The schooner Sybil Marston, built to the order of Capt. W. H. Marston of San Francisco, was launched from the yard of W. A. Boole & Son, Oakland, Cal., June 29. The vessel, which is rated as the largest schooner on the Pacific coast, is 215 ft. long, 42 ft. beam and 16 ft. 6 in. depth of hold. She is to be fitted with oil burners and 800-H. P. triple-expansion engines and will ply between San Francisco and northern coast points in the lumber trade. She is expected to be in commission within a month.

Work on the new turbine steamer Belfast, building for the Eastern Steamship Co., of Boston, and which is a duplicate of the Camden, recently put in commission, is progressing rapidly at the yard of the Bath Iron Works, Bath, Me., and it is expected that she will go into commission early in the summer of 1908. The Belfast will run between Boston and the Penobscot. The Camden, which was built at the same yard, was delivered to the owners three weeks ahead of the contract date and it is believed that equally as good time will be made on the Belfast.

The Newport News Ship Building & Dry Dock Co., Newport News, Va., were recently awarded a contract by the United States government for the construction of a self-propelling suction dredge, 200 by 40 by 28 ft., to cost about $250,000. This company's bid for two steel dredges for the Isthmian canal commission, to cost $160,000 each, and to be 160 by 40 by 12 ft., was also accepted and contract awarded. These dredges, which are for use in shallow water, will not be equipped with propelling machinery.

The Sloan Bros. Co., Seattle, Wash., have been awarded a contract by the Pacific Coast Steamship Co., San Francisco for the construction of a coal barge 180 ft. long, 37½ ft. beam and 15 ft. deep. The barge, which will be launched about Sept. 1, will be fitted with modern machinery built by the Link-Belt Co., Chicago, and will be the only one of its kind on the Pacific coast. It will have a capacity of 1,000 tons of coal which will be unloaded from the barge onto vessels by means of bucket conveyers. The barge will be stationed at San Francisco.

The Vinyard Ship Building Co., Milford, Del., launched the passenger and freight steamer West River recently. The vessel is for the Annapolis & West River Steamboat Co. of Baltimore, and will run between Baltimore and West River, Md. She is of the following dimensions: Keel 112 ft., beam 23 ft., and depth of hold 7 ft. She is to be equipped with a 300-H. P. engine and is expected to attain a speed of 15 miles an hour. Accommodations are provided for 350 passengers and when completed the vessel will have cost $50,000. She is to be delivered to her owners in a completed state at Baltimore, Sept. 10.

The board of county commissioners of Seattle, Wash., has recently let the contract for the construction of a new ferry for King county to ply between Madison Park and Kirkland. The vessel will be constructed at the Carlson yard at Port Blakely, Wash. She will cost $66,000 and is expected to be in service by Jan. 1, 1908. The dimensions of the ferry are as follows: 160 ft. long, 38 ft. beam, 42 ft. beam over guards, 10 ft. 10 in. depth and draught not to exceed eight feet loaded. The new craft, which is to burn coal, is to have a speed of at least 12 miles an hour, will be double-decked and will carry approximately 300 passengers.

The New England Co., Bath, Me., has the four-masted schooner Alice Holbrook, owned by W. B. Boune, New York, at its yard for repairs.

The Fore River Ship Building Co., Quincy, Mass., launched the new steamer Everett, July 11. The Everett is the first of the three colliers building at this yard for the New England Gas & Coke Co. of Boston to go overboard. The vessel is 399 ft. 10 in. over all; breadth, moulded, 52 ft. 9 in.; depth, moulded, 32 ft. 6 in.; draught, loaded, 24 ft., and is designed on the self-trimming plan with a view to loading and discharging her cargo with great rapidity. Her engines are triple-expansion with cylinders 28 in., 44 in., and 73 in., by 48-in. stroke, steam being supplied by four single-ended boilers at a pressure of 180 pounds. The two sister ships will be named Malden and Melrose.

THE CAPTAIN MANAGED IT.

Some men in a public house were inventing stories to pass the time away. They had all had a turn at it except an old sailor, who had remained silent all the time until pressed by the others to spin them a yarn. He began:

"I was once in a dreadful storm. All the provisions were washed overboard. I was very ill and ate nothing for four days. At the end of that time I began to feel hungry, and the steward gave me beef, chicken, port wine and eggs."

"But you said all the provisions were washed overboard. Where did the beef come from?"

"From the bullocks" (bulwarks), said the old sailor.

"Where did you get the chicken."

"From the hatch."

"And the port wine?"

"From the porthole."

"And the eggs?"

"Eggs?" said the sailor. "I didn't say eggs, did I?"

"Oh, yes you did," said the men. "We've caught you now."

The old sailor thought he was caught and had to consider. At last he said:

"Oh, yes. I did have eggs. The captain ordered the ship to lay to, and he gave me one."—*London Queen.*

The Atlantic Works, Inc., 28th Street and Gray's Ferry Road, Philadelphia, Pa., recently received an order from the government for a 40-in. band resaw machine to be used at the Charleston navy yard.

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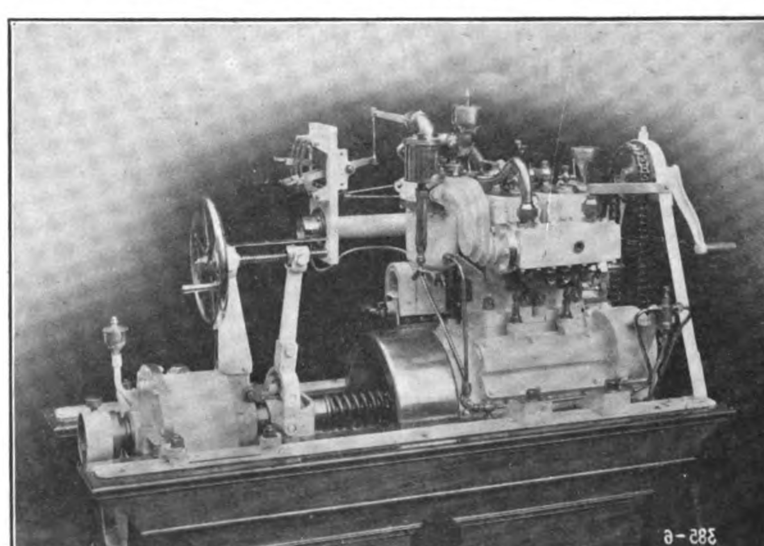
MISSIONARY MOTOR LAUNCH.

Among the many diverse uses to which motor launches are now put, we have already had instances of boats for the use of missionaries among fishermen at home and abroad.

MISSIONARY MOTOR LAUNCH.

The subject of this article is a motor launch recently delivered at Rangoon by the builders, Messrs. John I. Thornycroft & Co. Ltd., of Chiswick, to the Rev. T. Wright, Port Chaplain of the Missions to Seamen at that port. Having very graceful and easy lines, the boat is capable of a speed of about 10 miles per hour, ample enough for all purposes for which it might be required by its owner, and a very satisfactory rate for a boat of 35 ft. length, 6 ft. 9 in. beam, and 2 ft. 1 in. draft, to be propelled by its two cylinder 12 B. horsepower Thornycroft engine.

The hull is carvel built of teak, the outer skin being sheathed up to the waterline with 22 g. copper, this being essential owing to the deleterious effect on wooden hulls of the water at Rangoon, where the temperature is often 100° in the shade, and the river which runs at about five or six miles per hour is yellow with the mineral deposit which in many tropical districts proves so destructive to wood. The fashionable canoe stern and good freeboard give the boat a smart appearance, and the rockered keel and absence of dead wood aft make her extremely handy and quick in turning and maneuvering. The accommodation is ample,—26 persons or more may be comfortably seated if necessary, while on the other hand, the boat may be operated by only one person, as the steering wheel is fitted within easy reach of the motor controlling levers. On the trials, the engine which is too well known to readers of the MARINE REVIEW to need further description, gave proof of the flexibility and ease of starting and running for which it is notorious. Half a turn of the handle sufficed to start it on the first run after it was installed in the boat. The propeller is of Messrs. Thornycroft's special design, and is protected in case of grounding by a skeg forming the lower support of the rudder. The boat presented a most comfortable and attractive appearance during its trials at Chiswick, with its green Willesden canvas awning reaching from stem to stern, and the representative of the owner expressed great satisfaction both with the result of the trial, and the general construction, arrangement and finish. Moreover, in happy contrast with many types of motors and boats after they have reached the buyer's hands, the Rev. T. Wright has stated in letters to the London office of the Missions to Seamen, as well as to the builders direct that he is very well satisfied with the launch, her trials at Rangoon having been very successful, and she promises to be a very useful boat.



ENGINES OF MISSIONARY MOTOR LAUNCH.

BOILERS IN A GOVERNMENT VESSEL IN BAD SHAPE.

BY GEORGE W. BACH IN *Power*.

In July, 1903, the United States collier Brutus arrived in Pago Pago (Pango Pango), Samoa, long overdue, with a cargo of coal for the naval station on the enchanted isle of Tutuila. Upon arrival the captain reported considerable boiler-room trouble, including the collapsing of three furnaces, splitting of more than two hundred tubes and several other mishaps. This vessel was manned by a merchant master and crew, and the writer was serving in the capacity of chief machinist on the U. S. S. Wheeling. The latter being in port at the time, I was detailed to inspect the boilers on the Brutus before they were cleaned.

It requires a more facile pen than mine to describe adequately the conditions I found. Three of the corrugated furnaces were "down" so bad that one boiler had been cut out entirely and the pressure reduced on the other. The tubes that leaked were perforated with numerous small holes that looked as if they had been drilled with a No. 24 drill and slightly countersunk. The shells of the boilers showed signs of deep corrosion and pitting everywhere. There was not a vestige of the zinc slabs that were supposed to be in the boilers, although the baskets and hangers were still in place.

The entire water space in each boiler was covered with from ⅛ inch to

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2 inches of peculiar brown sediment and a crude analysis of some of the scale showed the key to what appeared to be a strange puzzle. The engineer in charge said that he first came aboard on the morning prior to sailing, when practically everything was in readiness for departure, and that although he had on several occasions requested time to clean the boilers, the captain refused to grant this request, as he had orders to hurry. The salinometer test showed a saturation of about 3-32 and the water was not allowed to become denser. The boat steamed to her destination around the Horn, a trip of about 15,000 miles, without giving the engineer an opportunity to clean the boilers.

The brown sediment referred to was nothing less than copper paint, with which the double-bottom compartments carrying the fresh water for boiler-feed had been painted, and for some reason this paint had been scaled off and was of course taken into the boiler by the auxiliary feed-pump, or whatever device was used. The action of electrolysis caused by the copper present can only be conceived by an engineer who has had actual experience in this line. After decomposing the zinc plates, the corrosion next attacked the tubes, and in fact all the exposed metal. The boilers were thoroughly cleaned, retubed and new zincs fitted. A templet was made from light railroad iron by means of a portable forge and two 20-ton hydraulic jacks; the furnaces were put back to the true radius and several minor repairs made.

GREEK TORPEDO DESTROYER.

On July 10, in the presence of a large gathering including official representatives of the Greek community in Great Britain, a torpedo-boat destroyer built for the Greek government was launched from the yard of Messrs. Yarrow & Co. at Poplar, and received the name of Lonhi. The Greek minister, who named the boat on behalf of the King of the Hellenes, was accompanied by Mme. and Mlle. Metaxas, and the staff of the legation. After the religious ceremony by the Rev. Great Archimandrite Pagonis, the Greek minister made a speech suitable to the occasion, and the launching took place amid the cheers of the company. The dimensions of the boat are: Length, 220 ft.; breadth, 20 ft. 6 in.; and depth, 12 ft. 4 in.; i. h. p., 6,000; contract speed, 31 knots. The Lonhi is the third vessel of this class built by Messrs. Yarrow & Co. for the Greek government.

ELECTRICITY ON BOARD SHIP.

BY SYDNEY F. WALKER.

As in every other industry, electricity is now making its way on board ship, but the struggle has been a long and severe one. There has been no question of advancing by leaps and bounds. Each advance that has been made has been the result of hard work, careful thought, and continuous sticking to, by those who have pioneered the work. The conditions present on board ship are the most severe that electricity has to encounter. In electrical work there are two principal agencies that make its development hard, and that causes trouble to those who look after the apparatus, viz., vibration and wet. The vibration of the ordinary well-built house or factory, due to the traffic in the roads the buildings border, and to the motions that are more or less always present in the earth's crust, are sufficient to lead to troubles of various kinds. Many a telephone trouble has been caused by the flick of a housemaid's duster, following a period during which a wire has been exposed to the ordinary vibration to which every house is exposed. On board every ship, the vibration of the main engine is ever present, and is unavoidable, and it is a great many times more severe in its effect than the most troublesome vibration that is met with on shore. In addition to this, also, which may be considered as the everyday condition of a ship at sea, there is the working of the ship in a sea-way, and the special and particular motions of the parts of the ship which it gives rise to, which are all transmitted to any electrical apparatus that may be fixed in the ship. Water of all kinds is another very bad enemy of the electrical engineer. Many a trouble has been caused by an apparently small drop of water that has condensed on the cold surface of a wire, through which an electric current was passing, or was intended to pass; and, again, when the water is impregnated with salts, such as those always present in sea-water, the effect is very much increased. Electrical apparatus is full of what electrical engineers call "connections"—points at which the current passes from a wire or cable to a terminal, to a mass of metal, to another wire—and so on; and these points, where connections are made, are the points to which the vibration of the engines, and of the ship, and the sea-water, or the salts that are deposited from it, tend to bring trouble. Many connections are made by bending a wire or cable round a screw, and tightening the screw up; in other cases, connections are made by pushing the bared end of a wire or cable into a hole in a mass of metal, and tightening a screw upon it. With other connections, such as those to the commutators of continuous-current dynamos, wires are soldered together, and to pieces of metal, to which they are to transmit the current. In all these cases, and others, vibration tends to loosen the connections, and water, if it is present, tends to set up electro-chemical actions, eating away some of the wire or metal, and gradually destroying the connection between the two. And this is not the whole story. When a connection between a metal and a cable is shaken loose, sparking takes place between the loose metals, if other conditions are favorable; and often an arc, as electrical engineers call it, is set up, similar to that with which marine engineers are familiar in the arc lamp, but very destructive in its operation. The arc, when formed, creates an intense heat, some thousands of degrees Cent. with the result that substances in its immediate neighborhood are seriously damaged, and particularly insulating materials. Insulating materials, which are of such enormous importance in connection with electrical work, are mechanically very weak; few of them can resist high temperatures, and they are the bane of the engineer's life generally. An arc formed in the neighborhood of any insulating material destroys it in a very short time. When the electric incandescent lamp was first introduced, it was seen that it was the very thing for use on board ship; but some of the troubles that have been mentioned above immediately arose. The ordinary capped lamp, fitting in its lamp-holder, with plunger contacts, was a frequent source of trouble, and for a long time in the English navy it was the common practice to form two hooks on the ends of the wires conveying the current to the lamp, and to hook the lamps in them by means of the platinum loops that were used in the early lamps, it being found that the flexible connection so formed stood better, under the vibration of the ship, and its knocking about in a sea-way, than the comparatively rigid connection of the capped lamp and its holder. Again, cables for a long time were a great source of trouble. Many ships have to pass through different climates with very short intervals of time, a comparatively few days, in some cases, taking the ship from tropical heat to the low temperatures of temperate winter, and some of the insulating materials would not stand the change. Other insulating materials employed for cables would not stand salt water. In the case of men-of-war, also, considerable difficulties arose in carrying cables through the watertight partitions. Again, in the early days of electric light-

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ing the engines and dynamos, even on shore, were not all that could be wished; and certainly they were not capable of withstanding what often came against them in the engine room of a steamship. When the steam turbine was first introduced in 1887, it was hailed as the thing for generating current for the lighting of steamships. It occupied a very small space, it required practically nothing in the way of foundations, and apparently it required little attention. Yet the writer believes that there is not a single steam turbine that was fitted on board ship in those days, in use at the present time. It is not surprising, therefore, if the later developments, the adaptation of the electric motor to driving winches, capstans, hoists, etc., took a considerable time in developing. It was shown a good many years ago that the steam winch was a very wasteful machine in the matter of steam; but it was replied, with justice, it did its work. It could be depended upon to load or unload a steamer without stopping. It would stand all the rough weather to which the steamship was exposed, and be ready for work on arrival in harbor with a very little attention; whereas it was at that time very doubtful indeed whether the bulk of the engineer's time would not be spent in coaxing an electrically-driven winch to work under the most favorable conditions. Notwithstanding all this, however, electricity has made its way, and is now adopted in all the large steamship lines for a large portion of the work, for the lighting of the ship generally, for searchlights, for lights for discharging and loading cargo, for capstans, winches, boat-hoists, etc. It has also forced its way into the man-of-war, and is gradually displacing hydraulic machinery, notwithstanding the undoubted convenience and flexibility of the latter, for loading and training guns, for training turrets, and for ammunition hoists. It is also very largely employed for the necessary work of cooling iron-built ships in the tropics, and it is gradually displacing the small engine, of which there are now so many about every ship, driving auxiliary machinery. It is employed for working the tiller, and for indicating on the bridge and in the captain's cabin the position of the tiller; it is also employed for indicating in the captain's cabin the position of the compass. In the matter of communication between different parts of the ship it has also, after a very severe struggle, gradually taken its place; and telephone apparatus is to be found in the principal departments of every large steamer of the principal lines. Further, wireless telegraphy has come to stay, and is gradually being fitted in every steamer of any importance, since it enables continuous communication to be kept up between the ship and one shore, either the shore it is leaving, or that it is approaching, and to communicate with other passing ships; and, in the writer's opinion, it is more than probable that wireless telegraphy will be the ultimate solution of the exceedingly troublesome problem involved in the communication between ships and the shore, during fog. Fog, it is well known, is impervious to sound and light; it is not impervious to electric waves. In the following articles, the writer proposes to describe the apparatus that are in use on board ship, to give a simple explanation of the principal upon which they are constructed, of the principles governing the sizes and arrangements of cables, the arrangement for the adaption of electric driving to different kinds of machines, also the different forms of wireless telegraphic apparatus and to give instructions, drawn from practical experience, for dealing with the causes of failure. It is hoped that the articles will be of service to those who go down to the sea in steamships, particularly to the younger generation, who should take every opportunity of acquiring knowledge which will be useful to them in following their profession.

THE CONTINUOUS CURRENT DYNAMO.

In the early days of electric lighting on board ship, the dynamo was usually run at about 65 volts, this being the pressure that was somewhat popular on shore at that time. It was a convenient pressure to run arc lamps from for cargo purposes, the ordinary arc lamp taking 50 volts for itself, and requiring another 15 volts, which was wasted in a resistance provided with it, without which the lamps would not work properly under those conditions. Later on, the admiralty adopted a standard pressure of 80 volts, principally, the writer believes, because it was a convenient pressure for running searchlights from, the arc lamp employed with searchlights taking a higher pressure than the ordinary cargo lamp, and requiring a certain resistance as well. Since then the advance has been made to 100, 105, and 110 volts, and there is no reason that for power work, with the increased length that is being given to every new ship that is built, that 200 or even 500 volts should not be employed, as that will enable the size of the cable to be kept within moderate dimensions.

But for lighting purposes it will be wiser to keep the pressure as low as possible, because the high-pressure incandescent lamps—those for 200 to 260 volts that are so commonly used on shore now—take more electricity for a given candle power than the lower voltage lamps; and, what is more important, they are very much more delicate.

As will be explained later in the articles, the 200-volt filament for any given candle power is more than twice the length of the 100-volt filament, while it is about half the thickness, and, consequently, is very subject to breakage from the vibration of the main engines and the jerks it must necessarily receive when the ship is knocking about in a seaway, and, in the case of men-of-war, when the big guns are fired.

THE PRINCIPLE OF THE DYNAMO.

The principle upon which dynamo machines, both for generating current and for converting current into motive power, are constructed is, when a conductor crosses a magnetic field, an electrical pressure is created in the conductor, and, if there is a complete path for it, a current flows in obedience to the pressure created. The magnetic field is the space in the immediate neighborhood of a magnet, in which the force known as magnetism is apparent. With an ordinary bar magnet, the magnetic field is principally in the neighborhood of the ends of the bar, but traces are to be found, in the case of a powerful magnet, all round the bar and for a certain distance away from it. With a horseshoe steel magnet the magnetic field is confined to the immediate neighborhood of the two poles, and principally to the space between the poles. Faraday conceived the idea that what he called "lines of force" extended outwards from the poles of magnet, and that the number of these lines were in proportion to the strength of the magnetic field. An idea of the magnetic field may be formed by the well-known experiment of placing a magnet underneath a sheet of paper or of thin glass, and sprinkling iron filings over the paper or the glass. The filings will be seen to arrange themselves in a particular order, and to be bunched in the neighborhood of the poles, and, in the case of the horseshoe magnet, to be principally confined to the space between the poles, as mentioned above. The line of magnetic force is now understood to be a definite quantity, and electrical engineers talk of creating a certain number of lines of force, or a certain strength of magnetic field, in a given space. They design their machines to create the given strength of magnetic field and the given number of lines of force, and the results obtained if the design is in accordance with the now well-known principles, agree with the intention of the designer. In the dynamo a magnetic field is created in a cylindrical space enclosed between crescent-shaped pieces of iron, forming part of what are now called the field magnets. In the modern dynamo there are several field magnets and several crescent-shaped pole pieces, as they are termed, enclosing cylindrical polar space in which that portion of the machine

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called the armature, which carries the conductors in which the electrical pressure is to be generated, revolves. The strength of magnetic field obtainable with permanent steel magnets is very limited, and, in addition, it is not constant, the steel gradually losing its magnetism from the moment it is put into service. Forms of permanent steel magnets are now made which retain their magnetism for a long time, but they are only small in size, and are used entirely for some of the measuring instruments that will be described later on. The magnetic field of the dynamo is created in all cases now by electro magnets. The electro magnet is a piece of iron round which an insulated wire has been coiled, and it becomes a magnet, similar to the steel magnet, and with the same properties, when a current passes through the coils surrounding it. The number of lines of force created by an electro magnet may be taken to be approximately proportional to the sectional area of the iron core, as it is called, the mass of the iron round which the wire is coiled, and to the strength of the current passing in the magnetizing coils. The statement is not strictly accurate, as the number of lines passing through any given piece of iron or steel, and thence into the space dominated by the electromagnet, increases very rapidly with an increase of current during the early stages of magnetization, and very slowly as the number of lines of force created reach a certain definite quantity, but it is correct for the degree of magnetic saturation usually employed.

Iron varies in the readiness with which it accepts magnetization. As electrical engineers express it, all substances offer a certain resistance to the passage of the lines of force through them. Air, the metals (with the exception of iron, nickel, and cobalt), and pretty well every other substance offer approximately the same proportional resistance, which is something like 1,400 times that offered by wrought iron. Nickel and cobalt offer a little less resistance than the other substances; but, for practical purposes, iron or its alloys, cast iron and steel, are the only metals available for use in the construction of dynamo machines and apparatus where a powerful magnetic field is required. Cast iron has a little more than twice the resistance of the best wrought iron. There is not much difference between the various brands of good wrought iron, and mild steel offers about the same resistance, while a special form of steel that has been produced at Sheffield for some years now, offers practically the same resistance, in some cases even less than the best Swedish wrought iron, and can be cast into any form that may be desired, greatly facilitating the construction of dynamo machines. In the modern continuous-current dynamo there is a circular enclosing ring from which iron cores of usually circular, but sometimes of elliptical or rectangular section, project radially inwards, each core having a coil of cotton-covered copper wire surrounding it, and having the crescent-shaped pole-pieces mentioned at its inner end, the pole-pieces, together with the space between them, enclosing the cylindrical polar space. In this cylindrical space a drum, built up of plates of thin iron or mild steel, or special magnet steel, is suspended upon an axle, the axle running in bearings carried either by pedestals fixed to the bed-plate of the machine, or by brackets supported by the circular enclosing magnet ring. The core-plates of the armature-drum are now always slotted on their peripheries, the slots forming channels in which copper conductors are laid, and a powerful magnetic field, or, rather, a number of separate magnetic fields, are created between the crescent-shaped pole-pieces and the core-plates of the armature drum. The lines of force pass from one of the pole-pieces, say the north seeking pole (that which, if the magnet core and its coil was suspended freely, would turn to the magnetic north), across the small air space intervening between the pole-piece and the iron drum, through the portion of the iron drum interposed between the north pole and its companion south pole next to it, thence across the air space to the south pole, through the iron core of that limb of the electro-magnet, through the portion of the enclosing ring between the two limbs of the electro-magnet, back to the north pole-piece. Between the pole-pieces and the iron drum the lines of force are congregated, passing almost perpendicularly from one to the other, and, when the conductors held in the slots on the iron drum are whirled round by its revolution, they cut the lines of force at right angles, that being the most favorable angle for the purpose.

The continuous current dynamo is usually arranged to provide its own magnetic field. As electrical engineers express it, it is self-exciting. After any mass of iron has once been magnetized, it retains a certain quantity of magnetism, which gives rise to a feeble magnetic field. When a dynamo is finished, the first thing that is done, before it is run for testing, is, a current from any convenient source of electricity, such as the dynamo that is used for lighting the works, is passed through the field coils of the machine, and the iron cores of the field magnets thoroughly magnetized. After that is done the machine is run by itself, and quickly provides its own magnetic field. The feeble magnetic field remaining after the exciting current has been cut off, generates a feeble electrical pressure in the coils of the armature, when the latter is revolved in the polar space. The small pressure created causes a small current to pass through the field magnet coils, this small current increasing the magnetism remaining from the preliminary excitation. The increased strength of the magnetic field so created, generates an increased pressure in the conductors on the armature, this causing an increased current to pass through the field magnet coils, and so on, until the machine has built up the full pressure for which it is designed, this taking usually only a few minutes at first, and only a few seconds after.

In practical work it is sometimes arranged that the current for the field magnet coils is supplied from a separate exciting dynamo, run specially for the purpose. This is a very convenient arrangement, where, as in modern generating stations of all kinds, two or more dynamos are running together, as it enables the excitation of any individual dynamo to be varied conveniently, and at will. For small stations, however, the more usual practice is for the dynamos to be self-exciting, and there are three forms of self-excited dynamos, known respectively as the series wound, the shunt wound, and the compound wound.

THE SERIES WOUND CONTINUOUS CURRENT DYNAMO.

In the series wound continuous current generator, which is not much used at the present day, only occasionally, in fact, for arc lighting, the field magnet coils are formed of thick wire with a few turns only, the wire being sufficiently large to carry the whole of the current the machine is capable of generating. The current is taken from one of the brushes, which receive it from the armature, as is explained below, through the coils of the field magnet to the outer circuit, the second cable for the outer circuit being connected to the other brush. The peculiar feature of the series wound generator is, every variation in the outer circuit is reflected, not only in the armature, but in the field coils, and therefore doubly in the armature. Thus, if the resistance in the outer circuit increases, as will be explained later, leading to a decrease of the strength of the current passing in the circuit, the field magnet coils, having a smaller current passing round them, create a magnetic field of smaller strength, this giving rise to a smaller pressure in the armature coils, this again reducing the strength of the current passing in the circuit. On the other hand, if the resistance of the outer circuit is decreased,

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a larger current passes through the whole circuit, the increased current strength gives rise to an increased magnetic field, and this again causes increased pressure in the armature coils. The readiest illustration of this is where a single arc lamp is fed from a single series wound generator, driven by a steam engine. When the arc burns long, the resistance of the whole circuit is increased, the current is decreased, and the pressure the machine is generating is also decreased, with the result that the lamp is very liable to go out. On the other hand, if, as very frequently happens, the arc suddenly shortens considerably, the resistance of the circuit is thereby decreased, the current passing is very much increased, and the pressure created in the armature coils is also increased, this leading to a further increase, and very often to the engine pulling up, since it is suddenly called upon to do largely increased work.

THE SHUNT WOUND GENERATOR.

In the shunt wound machine the field magnet coils are supplied with a current forming only a small fraction of that generated by the armature. The coils are wound with fine wire, and the current passes round the iron cores a very large number of times, the increased number of coils making up for the small current strength. The ends of the coils are connected to the brushes which receive the current from the armature. The working of the shunt wound machine is the reverse, in almost every respect, of that in the series wound machine. Variations in the outer circuit are reflected in the field magnets, and thence in the armature, but in the reverse manner to that described for the series wound machine. When the resistance in the outer circuit increases, the pressure at the brushes—and therefore the current passing in the coils of the field magnets—increases, and the pressure generated by the armature itself increases. When the resistance of the outer circuit decreases, the pressure at the brushes and the current passing in the field magnet coils decreases, the pressure created by the armature also decreasing. In the early days of the incandescent lamp the shunt wound machine was employed for furnishing current for a number of lamps, as it was so very much more suitable for the work than the series wound machine; but the trouble arose that, if a number of the lamps were turned out, the pressure delivered to the remaining lamps was increased, unless the speed of the dynamo was decreased, or other means were taken of reducing the pressure, and the lamps remaining in circuit were very seriously strained. Hence the shunt wound machine, except where it is used as a separately excited machine, has given place to the compound wound machine, described below. The reason of the rise and fall of the pressure generated in the armature, with increase and decrease of resistance of the outer circuit, will perhaps be understood better from the following. A given armature, with a given number of conductors upon it, moving at a certain speed through a magnetic field of a certain strength, creates a certain pressure in its own coils. This is the total pressure created. The pressure delivered at the brushes, and to the outer circuit, and to the field magnet coils, is this initial pressure, less a charge upon it for the passage of the current passing through the armature coils. Whenever an electric current passes through a conductor, the resistance of the conductor makes a charge upon the initial pressure for the passage of the current, the charge being measured by the product of the current strength into the resistance, the pressure delivered at the end of the resistance being less than the initial pressure by this charge. Thus, if the armature of a dynamo generates a pressure, say, of 101 volts, and has a resistance of 0.1 ohm., the passage of a current of 10 amperes through its coils will reduce the pressure at the brushes from 101 volts to 100 volts. The passage of 100 amperes will reduce it to 91 volts, and so on.

The current passing through the field magnet coils depends directly upon the pressure at the brushes, the pressure which remains after the charge has been met, and inversely upon the resistance of its own coils. As the resistance of its own coils may be taken as constant, the current passing in them varies directly as the pressure at the brushes, and, therefore, inversely as the current passing through the machine. It should be noted that, in the extreme case where a shunt wound machine is short circuited, where an infinitely low resistance connects its terminals, such as a short piece of metal, the machine furnishes no pressure and no current. It is practically dead.

THE COMPOUND WOUND MACHINE.

The compound wound machine is a compound of the series and shunt wound machines. Its field coils consist very largely of fine wire, arranged as a shunt to the external circuit, the ends of the coils being connected to the brushes as in a shunt machine, but a certain portion of the magnetism is supplied by a few turns of thick wire, through which the whole of the current supplied by the armature passes. When no current is passing to the outer circuit, the series coils furnish no magnetism. When current is passing out to the outer circuit the series coils furnish magnetism exactly in proportion to the current passing, and the number of turns is so arranged that the current passing in them makes up for the magnetism that would be lost by the reduction of pressure at the brushes, and it also furnishes sufficient to provide for the charge upon the initial pressure created by the armature for passing the current through the series coils themselves. A natural corollary to this is the over compounded machine, as it is called. It will be evident that it is simply a matter of calculation to provide an increasing pressure at the ends of the series coils instead of a constant pressure, and this arrangement is often made use of to provide a constant pressure at some point at a certain distance from the generator. Thus, in the case of a big ship, it may be convenient to provide a constant pressure, say, in the neighborhood of the forecastle, or in the neighborhood of the after cabins. This arrangement enables smaller distributing cables to be employed, and is often a consideration. Where space is important, as it sometimes is on board ship, it may be worth while to make this economy.

SUBMARINE BOAT EQUIPPED WITH KOERTING SIX-CYLINDER OIL ENGINES.

BY FRANK C. PERKINS.

The accompanying drawing, Fig. 1, shows the arrangement of two six-cylinder German engines of the Koert-

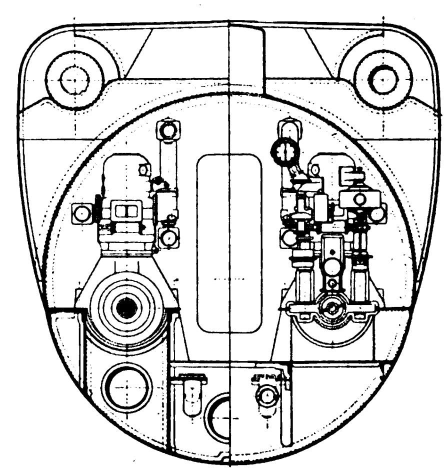

FIG. 1.—SUBMARINE BOAT EQUIPPFD WITH TWO KOERTING SIX-CYLINDER OIL ENGINES.

ing type installed in a submarine boat, while Figs. 2 and 3 are illustrations of these engines which are of the valveless two-cycle type each having a capacity of 200 H. P. There are a number of engines now constructed using petroleum as a fuel and these internal combustion motors are not only economical in operation but are less dangerous than the gasoline en-

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gines, especial for use in a confined space such as a submarine boat.

These engines are constructed at Koertingsdorf, near Hannover, Germany, by the Gebruder Koerting Actien-Gesellschaft, and these engineers in designing this engine have done away with the usual complicated gearing and valves, the position of the piston controlling the exhaust and inlet gases without the use of any valves whatever, the fresh air being admitted into the cylinder at the same time that the exhaust gases are discharged. There is said to be a certain charge of air forced into the cylinder between the hot exhaust gases and the fresh gas so that there is no danger of back firing.

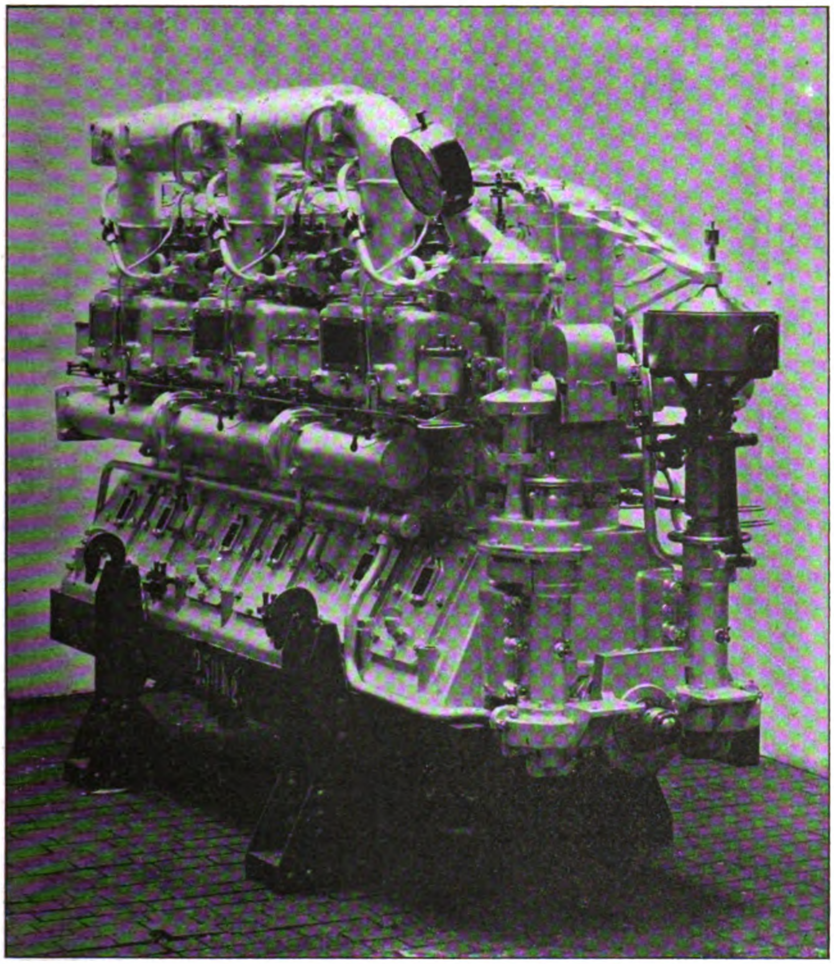

FIG. 2.—KOERTING PETROLEUM ENGINES FOR SUBMARINE BOATS.

These submarine boat oil engines are of great power considering their weight, delivering a total output of 200 H. P. at a speed of 500 revolutions per minute with a considerable overload capacity at 650 revolutions per minute. These six-cylinder engines are really three double cylinder units combined into one, the three pairs of cylinders being mounted on the same bed plate. The splash system of lubrication is provided, an oil pump carrying the lubricant to the various parts after it has been filtered and cooled, and the cylinders are cooled by usual water cooling system.

The six cylinders all exhaust into a common exhaust pipe and muffler and they have a communicating vaporizer heated from the exhaust gases while the gases are ignited by a contact low tension, electric magneto system. Direct-connected electrical machines are provided with these engines which charge storage batteries and the current from these batteries is utilized for operating electric-driven pumps for both air and water. In starting the engine the electric current from the storage batteries is used for driving the engines by electric motive power while electrically heated air is passed through the vaporizers and cylinders, to properly vaporize the oil in the beginning.

The air is heated by electric heaters and it is carried while hot into the jackets of the carburetters and the combustion chambers, and it is stated that the 200-H. P. engines can be started and placed in operation under full load in about four minutes, the petroleum fuel being heated by the combustion in the engines after once they are started.

For torpedo boat service as well as for submarine boats it is claimed these engines have shown great reliability, economy and safety while the necessary high speed is easily attained as the output of the engines is very high considering the weight and small space of these 200-H. P. units.

The Republic Belting & Supply Co., of Cleveland have in preparation a catalog covering the manufacture of leather belting in their plant. The entire process of manufacture of belting from rough leather to the finished belt will be told in photographs.

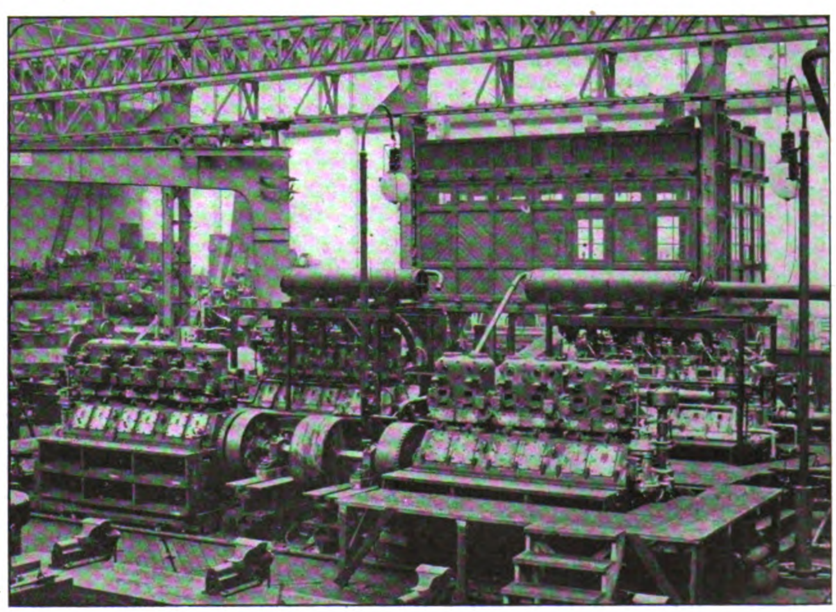

FIG. 3.—KOERTING PETROLEUM ENGINES FOR SUBMARINE BOATS.

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OIL FUEL FOR STEAMERS.

With oil fuel a proved success in marine engineering it ought not to be forgotten that as far back as June, 1903, Mr. R. Warriner, chief engineer of the Thames Iron Works, in an article in that company's *Gazette,* displayed an intimate knowledge of the subject. He described the chief sources of the oil and its applications to the raising of steam, but his analysis of the liquid was perhaps the most fascinating part of his study. Petroleum is, he said, highly complex, consisting of several hydro-carbons having different boiling points. When heated it gives off, first, the lighter oils, including benzoline and naphtha, which are very dangerous, flashing at 73 degs. Fahr.; secondly, the burning and lubricating oils, which are quite safe, flashing at 200 degs. Fahr. and upwards, and resisting the flame of a match; and lastly, paraffine wax and vaseline, leaving a residuum in the form of coke. This residuum is what is used for the firing of steam boilers. It is composed of carbon, hydrogen, and oxygen in the proportions shown in the following table, which gives also the composition of Welsh and North Country coal, and the heating power of the oil depends on the proportions in which these elements are present:

Composition.

	Carbon.	Hydrogen.	Oxygen.	Heating Power, B. T. U.
Russian crude	86.5	12.3	1.1	19,440
United States crude....	84.9	13.7	1.4	19,224
Do. do.	80.2	17.1	2.7	21,600
Texas, U. S. A., fuel oil	85.66	11.03	3.31	19,242
Coal (Welsh)	91.5	3.5	2.6	15,225
Coal (North Country).	87.0	4.0	3.0	14,860

It will be seen from the figures in this table, continues Mr. Warriner, that the heating power of oil, pound for pound, is greater than that of coal, and in use it is found to have a still greater efficiency over coal, as a much smaller quantity of air is required to burn one pound of oil than to burn one pound of coal, and whereas from the former there is no residue, from the latter there is a large accumulation of ash mixed with particles of unburnt coal and cinder. For these reasons one pound of fuel is equal to 1.75 pounds of coal. There are also certain other advantages, amongst which may be mentioned: Reduction of weight and storage, amounting to 30 per cent or 40 per cent; saving in labor in storing and handling the fuel; ease of firing and increased steadiness of steaming. The fires can be extinguished instantaneously and started immediately, a full head of steam being obtained in a very short time. The usual and best method of burning the oil is to spray it into the furnace by means of a steam jet. The only drawback is the "waste" of water. Mechanical spraying, while more satisfactory from this point of view, is less satisfactory in efficiency, a remark which applies also to the volatilization of the oil and the burning of it as a vapor. This question of burner is, in fact, the whole remaining difficulty.

All the destroyers in the navy estimates for the current financial year are to burn oil exclusively on their trials. In them, therefore, the system reaches its highest development. As their completion is some way off yet, however, interest not unnaturally centers in the eight vedette boats which the Thames Iron Works Co. is building for the Roumanian government. Four of these little vessels have been delivered, and four are almost ready to deliver. All of them are to be driven by petroleum residuum. There is a practically inexhaustible supply of oil in Roumania, and the annual output of the spring is increasing by leaps and bounds. Its analysis we do not at the moment know, but Mr. G. C. Mackrow, the company's naval architect, who has been in the country, says the quality is not surpassed by any other. It may, Mr. Mackrow believes, be safely bracketed with Russian. In 1905, 600,000 tons of crude oil were raised in Roumania, and there were at least 100,000 tons of residuum more than the country could use. Mr. Mackrow, to whom we are indebted for the particulars which follow, says, "in a few years this will be doubled. By residuum I mean the refuse oil, or tar, left after the benzine, benzoline, etc., have been given off. It is known in Russia and Roumania as Massuth, and is used as fuel on all the Roumania state railways and service maritime steamers, crude oil being expressly excluded on account of its low flashing point, viz., 73 degrees Fahr. The flashing point of the residuum must not be less than 212 degrees Fahr. on the steamers and 170 degrees Fahr. on the locomotives. At present the oil is brought from the oil fields at Campana in wagons by railway, each wagon containing 10 tons of crude oil, but a pipe line is about to be laid, and the oil will be forced or drawn through the pipes to the tanks in the harbor of Constanza. These are Government tanks, and all the oil raised in Roumania has to pass through them. There are sixteen of them at present, each containing 500 wagons of oil—80,000 tons that is to say. No tanks have as yet been appropriated for the storage of residuum only, as no export of it, on a scale worth taking note of, has been organized. If tanks had to be provided for shipping residuum on a large scale at all seasons of the year they would require to have special arrangements for heating, as low temperature makes it more or less viscous, according to the degree of viscosity and the percentage of paraffine which it contains. The Roumanian residuum has a calorific value of 12,000 against 7,000 to 8,000 for English coal, and 6,000 to 7,000 for Westphalian and Silesian coal, and it evaporates 10½ lbs. to 12 lbs. of water per one pound of oil consumed."

The vedette boats referred to earlier in this article are of mild steel below the water and of special bullet-proof steel above it. They are 100 ft. long, 13 ft. beam, and 6 ft. 10 in. deep; their draught is 2 ft. 9½ in. and their speed 18 knots. Their propelling machinery consists of twin-screw vertical compound engines, and steam is generated in a Thames Express water-tube boiler. The electric light installation consists of a 6 to 10 kw. engine and dynamo, tandem compound, running at 500 to 600 revolutions, one 20-in. projector with flashing shutters, and incandescent lamps in engine and boiler rooms, magazine, conning tower, officers' cabins and crew's quarters. The armament consists of one 3-pounder Skoda quick-firing gun on the conning tower, one mitrailleuse aft, two 14-in. torpedo-dropping gears, and two steel spars for spar torpedoes. The boats have been designed for the special service of guarding the railway bridge at Cernavoda against the attacks of possible enemies in times of war. This railway is, by the way, of great strategic importance to the defense of the capital.

Following upon the admiralty's decision to use oil fuel extensively in the navy we may expect an importation of residuum in large quantities. A new problem emerges just here, because in a time of war we should be obliged to fall back on our native supply of coal. Though oil fuel be used, provision will also have to be made for burning coal. There need be no difficulty on that score. The Roumanian service maritime vessels steam from Constanza to Rotterdam on residuum, and from Rotterdam to Constanza on coal. The oil flows by gravity from the tanks at upper part of the boiler-rooms to the burners or sprayers around the furnace doors. Wolff's sprayers are used, and very good sprayers they appear to be, but Mr. Warriner has improved on these and has brought out one of his own. The spraying into the furnace is accomplished by means of a jet of steam, and when the oil is lighted it is deflected by baffles in such a way that it is brought into contact with each range of water-tubes in turn. With care the combustion may be maintained perfectly. The floor of the furnace is of fire-brick with elongated openings adjusted for the efficient admission of air, and this floor eventually becoming heated ignites the fuel, which may be in some cases sprayed in at the lower part of the furnace. These bricks are, of course, placed upon the fire-bars. At Rotterdam they are removed, and the furnace is ready for the coal. Residuum is so clean and saves so much labor in the stokeholds that Mr. Mackrow believes its extensive use afloat to be only a mat-

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ter of time, and that it will soon become the exclusive fuel for all yachts. In fact, he has already suggested its use in the king's yacht.

OIL ENGINE FOR MARINE PURPOSES.*

BY MR. F. M. TIMPSON.

The value of paraffin oil engines seems to be fully appreciated for land purposes, judging from the number employed in all classes of work, and they can be found giving every satisfaction even in the hands of practically unskilled labor, the only skilled supervision being the periodical visit of the insurance inspector. This would seem to prove that the difficulties in running are not complicated and should cause no anxiety to the marine engineer of the day, but rather lessen same, as well designed oil engines have fewer working parts than those worked by steam, and if treated with care require but little attention. For some years past, motors obtaining power from low flash oils such as naphtha and petrol have been fitted as a general rule for the propulsion of pleasure boats, fishing craft, etc., in the United States and some continental countries and more recently in Great Britain. The service given by these motors has been as a rule satisfactory, but the dangers of explosion and fire from using these highly explosive spirits, coupled with the cost, has rather retarded much progress for use in every day commercial work. Still a lot of valuable experience has been gained and will, no doubt, prove of great service in the construction of engines to use the heavier and higher flash oils, and as there now seems a growing demand for engines using paraffin, makers are giving the matter attention, and we have a number of firms offering marine paraffin motors. Many of these are limited to power, and very few can give over 50 or 60 B. H. P., while others are unable to go over 10 or 20 B. H. P. At the present these do not seriously tackle a very important commercial demand which exists in the fishing industry, and with a view to this a firm with whom I am associated put in hand this year a large drifter with a three-cylinder oil engine of 250 B. H. P. which is, I believe, the largest oil engine yet made in this country. The engine in question was designed to have simplicity in working, and although not yet fully completed in respect to sea trials, has proved a thorough success as an oil engine. The engine is of the central valve type and Peck's patented design, having one valve on each cylinder head for admission of the charge and air valves with connection to the crank chamber and cylinder, in the first instance, for the supply of air pressure—which is obtained by the piston trunk working into an air-tight crank chamber, and in the second instance, to mix with the oil feed and supply fresh air to scavenge the cylinder, thus cleaning out foul gases before compressing the fresh charge. The oil is fed to the cylinder by gravity and controlled by a governor arrangement cutting off supply in the event of excessive speed. Combustion takes place every down stroke, and is of such a nature that the exhaust temperature on test was as low as 120° F., while there was no objectionable noise from the exhaust as is common with petrol engines of high power. To facilitate starting the engine, a small oil engine driving an air compressor is provided, and compressed air is used as an impulse in moving the main engines which are warmed up round the cylinder heads by the exhaust of the small engine being carried round them. I am not quite positive if the lamp for warming up is now entirely dispensed with, but believe such is the case, and in this type of engine the heat generated by the continuous combustion is sufficient to ensure a regular firing of the charge. Regulation of speed and reversing is accomplished by use of a feathering propeller which enables the pitch to be varied or the blades placed neutral, in which event the governor controlled the engine perfectly on trial, while the astern movement was prompt, the vessel being brought to a dead stop in her own length. It is considered by the makers that although objections are raised on account of feathering propellers it is mainly from the limited amount of experience in their use, as when of a strong and simple design, as in this case they admit of quick and easy handling of the vessel, one man working the steering gear and the driving engines. But in view of the actual necessity for a reversing engine where vessels are working in narrow and shallow waters, it is possible to make the engine reverse and a lighter job of this type is in hand at present. In addition to the drifter mentioned there is in course of construction twin oil engines of 360 B. H. P. for a trawler, now being fitted with the machinery at Leith, also two 60-H. P. engines have been recently delivered, one being duplicate of a set sent to Burmah, in the latter part of 1905, which is giving good service to its owners. The other has been installed in a sailing barge carrying 60 tons; this vessel successfully completed her trials recently and at the time of writing was lying at Leith with a cargo of coal for the south, where she resumes her station as a general carrier between the Isle of Wight and Southampton. This, I believe, is the first motor boat for ordinary commercial use built and engined completely in this country, the results from which are looked for with some interest. Other engines of higher power than any mentioned are contemplated, and with the proportions devised, a complication of cylinders is unnecessary and the weight of machinery is cut down to reasonable limits. This could be further decreased, but it is considered desirable to keep on the present lines until further experience is gained over longer runs. I may mention in the case of a vessel engined for Isle of Wight owners that a speed of over nine knots per hour was easily obtained.

Up to the present I have touched on what has been done within my knowledge as regards marine propulsion by paraffin engines of high powers, but as the engine is by reason of its steady running well adapted for electric lighting I may mention that a two-cylinder engine 150 H. P., has been constructed for a well-known engineering firm, and arranged to use so termed crude oil, also several small sets for train lighting in South Africa, and a set driving centrifugal pumps for irrigation purposes; these have all worked well and open up a point for consideration as to the adoption of oil engines in place of steam for auxiliary engines on board ship. This offers advantages in first cost and actual running, while the engines could be put in full power service in about three to five minutes from dead cold. In construction there would be a great saving in pipe lines, condensing plant, etc., which with the present price of copper would be considerable, not counting the labor in connecting up, the boiler power and consequently space would be capable of substantial reduction, also coal bunkerage in proportion which would outweigh any extra cost for engines. For electric lighting purposes my idea has been that this important plant should be on the main deck, as it has occurred within the memory of the majority that in the case of shipwreck the fact of the machinery being below water line

*Paper read at Institute of Marine Engineers.

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placed the vessel in darkness, thus adding horror and loss of life which perhaps might have been reduced if those who were lost could have seen what they were doing. Oil engines, being quite independent, would, of course, run as long as there was oil in their feed tanks. The same argument would apply in case of pumps, as in the event of fire there is no waiting to raise steam, and if engines are fitted with compressed air reservoirs which can be filled by a simple arrangement while at work, starting is quickly accomplished. Of course it may be said that with fire the presence of oil required for engines might aggravate the danger, but fire as a rule does not commence in the machinery space, and even if using high flash oils such could be stored in a double bottom well out of the danger zone. Generally speaking, there is a wide opening for auxiliary oil engines, not taking into account what may be done in the way of propelling machinery later on. Steam has taken many years to acquire its present efficiency and has gained that by the experience of many engineers in actual running.

In regard to cost of running oil engines of the type mentioned the consumption of oil is guaranteed not to exceed half pint per horsepower per hour, and, as a matter of fact, this has been considerably reduced in practice, figures for which I am not able to give at the moment but the comparison with steam will not be unfavorable with engines of equal brake horsepower. The oil engine does not lend itself to waste, as too much fuel will drown or stop it, and cost ceases from the moment of stopping till actually required for service again, while it is at disposal within five minutes as long as there is oil to hand. Stopping and starting at short intervals may hardly be so quick as with steam, but this can be much accelerated with a compressed air arrangement, and there is no danger in the quick start off which must occur with oil engines. Speaking of this point, it would be well to remember that as the crank shaft is given a sudden load it is advisable to allow a good margin of strength, as bending has been known to take place from this cause. An important point in the paraffin oil engine is that the engine be set to consume the class of oil that is to be obtained in the locality where it is to work, as it will be readily understood different oils vary in flash point, and using the wrong oil will occasion considerable trouble; this is much aggravated in the case of engines sent abroad and considerable difficulty has arisen from this cause. Another trouble that has come to my notice has been lack of allowance for difference in temperature of circulating water in tropical climates, and in the case of a barge engine recently tested the conditions of running were made as near as possible similar to where engine was to be located. When the engine is running, the exhaust vapor should be clear, and if of a smoky nature this shows too much oil is being supplied. Such may be remedied by putting a smaller nipple in the supply pipe, but there should be no sign of this defect with a properly adjusted engine when running full. If when starting up there is difficulty in getting away it will generally be found due to an overdose of oil which must be cleared away before a correct start can be made. In the engine I speak of it is considered correct after heating the cylinder head to turn on oil 10 seconds before applying impulse to the engine; of course, every engine will have its peculiarities which the attendant will soon become accustomed to. The matter of variation of speed in oil engines will still bear improvement, as supplies of air and oil require adjustment, this, I think, will soon be perfected and allow the same ease in speed variation as with steam. Another very important point is the maximum speed at which an oil engine can be driven with economy; high speeds may give greater power with a smaller engine but there is a time limit for combustion and any cutting of this means a passing of fuel through the exhaust; it would be considered good practice to make adjustments which allow for steady combustion throughout the downstroke; this leads to a steadier mean pressure and turning movement of crank. Many engines are more explosive than the internal combustion type. One is often asked how frequently oil engine cylinders require cleaning; this depends greatly on the attendance, and while in some cases engines may run for months others require looking to more often. It would not be a laborious job to have an inspection once a month, and certainly a very much easier process than boiler cleaning. Gumming up of the cylinder is increased by using unsuitable lubricating oil or using different oil fuel than the engine is set for; a case which came to my notice recently was caused by putting paraffin for the engine in a linseed oil cask, with the result that the engine soon gummed up and would not work. In engines of the enclosed type with piston trunk working into a crank chamber some difficulty is found in the inspection of bearings which may become dangerously hot before being noticed; this point has determined the construction of the open type as a necessity in large sizes. This gives greater security and also allows more expeditious overhauling and examination of the main shaft. Objections were raised against this on account of the height of engine, but these objections are found to be uncalled for in large engines, as the entire upper structure can be easily lifted. A feature in oil engines for marine propulsion is that engines, whether 1, 2 or 3 cylinder are independent units and can be cut out to reduce speed and consumption of fuel while the arrangement of engines should be that the breakdown of any one should not affect working of others. The parts should be made in standard sizes to gage, enabling them to be used for any of the driving engines. Cutting out one engine was tried in vessels mentioned which gave a fair rate of speed with reduced oil consumption proportionate to the power cut out; this is certainly an advantage as in steam practice the economy is not always proportionate in reduced powers. Of recent years gas engines with producing plant have been tried in canal barges with some degree of success, but this type of machinery is more complicated than the simple oil engines, and it is an open question as to any gain in economy over results from oil engine I have mentioned. The price of oil governs this, and I find considerable anxiety is occasioned by the present monopoly of the world's oil supply. Likely users say —What guarantee have we that with increased demand there will be no rise in price of oil? in which they are seemingly correct judging from the increased cost of petrol with larger demand owing to the number of motor cars, etc. Our late president mentioned in course of address to us in this room that his company had to destroy large quantities of crude oil for which they had no market, and advised us to give our attention to the internal combustion engine whose further adoption would doubtless widen demand for oil. I am sure the fact of any surplus supply is not common property, and it is more commonly considered that any increased demand would be met with higher prices. Some definite announcement by the oil trusts as to

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their line of action in case of increased consumption—which would be very largely augmented by general adoption of oil engines—would, I am sure, assist in getting them in use. This point has been brought up to me on many occasions and by people whose opinions are of weight. At the present we have several types of power in use—steam, hydraulic and electricity, all of which have a starting source in the boiler. Accumulator and dynamo and, I believe, oil coupled with compressed air, will be yet found equal in elasticity and reliability to any. It will be allowed by all that a considerable amount of experiment is required in a new industry, with failure and disappointment, in gaining perfection, but I have good reason to believe that the way is clear for higher powered oil engines. The firm I speak of will take on engines of 3,000 H. P., and with practical demonstration of reversing engine anticipate to have a number at work shortly in every day commercial work, anticipating from results to date that they will hold their own, if not more economical than steam-driven vessels. One question which arises in the adoption of motor power is that of handling cargo, as with steam vessels the boiler is always available of winches, and there is, of course, no such reservoir of power in the motor installation, but it may be overcome by using compressed air, which was done in the case of the drifter built and worked with satisfactory results on capstan and winch. Otherwise motor winches may be fitted, and to ensure efficient working a thoroughly reliable friction clutch must be fitted to handle winch, preferably one with clutch gear handle controlling both clutch and brake. Motors are not good starters on a dead load, so for hauling or lifting purposes the aforementioned requires careful consideration to ensure good working. A coil clutch manufactured by the Coil Clutch Co., Johnstone, would give efficient working in this service, and is adapted to couple with winch brake as mentioned. As a general rule, in internal combustion engines the one that has been designed for steadiest pressure throughout its stroke and not to exceed rate of piston speed suitable for complete combustion, should give the best results in practice; simplicity with accessibility of parts is essential to success, a complicated arrangement of springs and motions as in some types being not at all conducive to confidence, and for barge and fishing craft work the machine must be such as its working can be readily understood by any person of ordinary intelligence, trained engineers not being employed as a rule in these services. In closing this paper I wish to mention as not pretending to be an expert in oil engines, but such information as I have gained in daily contact with the development of the Peck engine may be beneficial in raising discussion on this important industry which is as yet in early stages.

SCRAPING OUT THE CYLINDER OF A MARINE ENGINE.

An English engineer describes in a recent issue of the Mechanical World how he scraped the shoulders out of a large marine cylinder in which the piston did not override the counter-

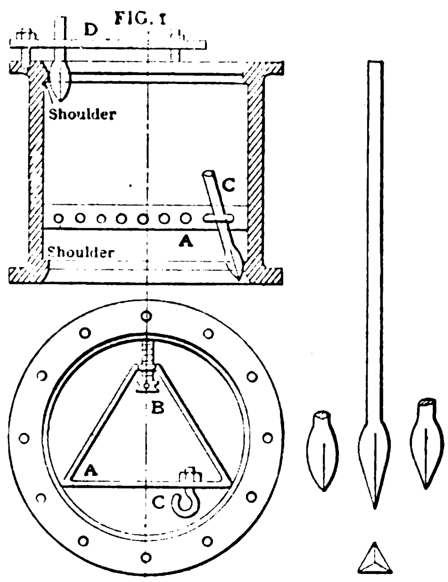

FIG. 3 FIG. 2

bore. As there was no boring tackle available, and it was almost impossible to chip the obstruction or use a file to advantage, the work was accomplished by the means illustrated

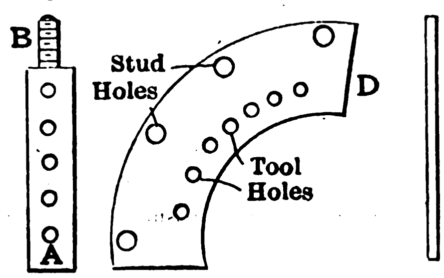

FIG. 4 FIG. 5

herewith. Fig. 1 shows the cylinder, the shoulders formed by the piston, and the general arangement of the tools, stays, etc. used.

Fig. 2 shows the tools, which were made of ⅞-inch octagonal steel (although round would do) 4 to 5 ft. long, one end being drawn out to a triangular point. Each tool had a different taper, and by this means the cut was regulated according to the angle at which the tool was held to the job.

Fig. 3 shows the tool stay A for working at the bottom of the cylinder. A piece of ⅝ x 2-in. bar iron was bent into a triangle and welded, the corners being slightly rounded and one base being longer than the others. At the corner opposite the long base a hole was tapped to take a ⅝-in. pointed screw B. This, when screwed out, together with the two opposite corners of the triangle, press against the walls of the cylinder, forming a rigid frame. Holes were drilled round the triangle to take a hook C or stud as desired, against which the tool pressed when cutting (Fig. 4).

Fig. 5 shows the tool stay D for working at the top of the cylinder. A piece of ⅜-in. plate was cut to about a quarter circle, and about 6 in. wide. Holes were drilled to the same circle and pitch as the studs in the cylinder, and inside these again a row of holes large enough to allow the cutting tool to pass through. In some cases the plate had to be packed off the cylinder face with washers to get the correct working height for the tool, but that would, of course, depend on the design of the cylinder, whether a deep or shallow bore. The bottom stay is easily regulated as to height by the set-screw.

After a little practice it is surprising what an amount of metal can be removed, the long lever giving unlimited power. A heavy or finishing cut can be given as desired by using the tools with different tapers.—*Power.*

BLACKBURN-SMITH FEED WATER FILTER.

The Blackburn-Smith feed water filter and grease extractor is described in a handsome catalog which has just been issued. This filter is for the removal of organic matter, sediment, lubricating oils, etc., from boiler feed water and for the removal of any matter in mechanical suspension in liquids where economy or quality of product is affected by the presence of such matter. Among the subjects treated in this catalog, are effect of oil on the boiler, utilization of condensed water from heating systems and condensers, methods of treating feed water, the removal of oil from condensation. The Blackburn-Smith feed water filter is manufactured by James Beggs & Co., No. 109 Liberty street, New York, who will send this catalog free upon request.

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THE MARINE REVIEW

DEVOTED TO EVERYTHING AND EVERY INTEREST CONNECTED OR ASSOCIATED WITH MARINE MATTERS ON THE FACE OF THE EARTH.

Published every Thursday by

The Penton Publishing Co.

CLEVELAND.

BUFFALO .... 932 Ellicott Sq.
CHICAGO .... 1362 Monadnock Blk.
CINCINNATI .... 124 Government Place.
NEW YORK ....1005 West Street Bldg.
PITTSBURG .... 521 Park Bldg.
DULUTH...............411 Providence Bldg.

Correspondence on Marine Engineering, Ship Building and Shipping Subjects Solicited.

Subscription, U. S. and Mexico, $3.00 per annum. Canada, $4.00. Foreign, $4.50. Subscribers can have addresses changed at will.

Change of advertising copy must reach this office on Thursday preceding date of publication.

The Cleveland News Co. will supply the trade with the MARINE REVIEW through the regular channels of the American News Co.

European Agents, The International News Company, Breams Building, Chancery Lane, London, E. C. England.

Entered at the Post Office at Cleveland, Ohio, as Second Class Matter.

August, 1, 1907.

EVCLUTION OF BATH'S SHIP BUILDING.

In speaking of the present aspect of wooden ship building, one of the oldest ship builders of Bath, Me., recently complained of the dearth of experienced workmen in the present boom, adding that the inability to get help was delaying the work to a considerable extent. In Maine's palmiest days of ship building it is reputed that it was no unusual matter to see as many as fifty large sailing vessels launched in Bath and vicinity in the course of a year. The question naturally arises—"What has become of the workmen who swarmed the yards in these past booming times?" With the gradual decadence of wooden ship building, it would seem that the men employed at the yards, and, who had looked forward to a life's work there, must have departed to fresh fields and pastures new. One can suppose that in Bath, whose chief industry in the past was her wooden ship building, the rising population would naturally look forward to employment in one of the five miles of ship yards. As the demand for apprentices and help declined, however, the budding ship builders cheerfully adapted themselves to circumstances and adopted other trades and means of livelihood. As there are no unemployed at Bath today, it would appear that such must be the case.

In later years the yard of Arthur Sewall & Co. undertook the construction of steel-hulled sailing vessels, opening a new branch of the industry in the wooden-hull region. The Bath Iron Works, again, comparatively young in years, is turning out steel ships with unfailing regularity. The Hyde Windlass Co., also, has gradually increased its engine and machinery business and buildings in recent years. Probably this will account for the lack of men for the timber work.

In Bath the motor boat has "arrived," and, seemingly, has come to stay. Builders of this latest type of craft are springing up along the water front, and the accompanying repair and supply shops are much in evidence. Several large motor-driven passenger boats are on regular service in the surrounding waters. The fisherman, with oars stowed and sails furled, swings down the river to the cheerful *putt-putt* of his motor exhaust. The business man, living at one of the many summer resorts up or down the river, steps aboard his little craft at close of day and steers for home. Every conceivable shape, size, and shade of boat (and some inconceivable) ply the waters of the Kennebec. All hail the gasoline motor.

Firms not a year old point to the remarkable growth of business as they devise the enlarging of their plants and look around for machinists. Even if a cynical shipping man *did* remark that the ter-centennial will celebrate the funeral of wooden ship building at Bath, its reputation as an up-to-date ship building, engineering and motor-boat port is on the ascendent, and the timber workers and riggers of the past are the steel workers and machinists of the present.

THE STRIKE IN THE IRON MINES.

It is impossible to state how soon the strike in the iron mining country will be ended, but indications are that it will fall through of its own weight during the present week. The Steel Corporation has maintained so far a practically negative policy but citizens in general have been quite active and a public sentiment has been created which is wholly against the strike. Public opinion usually has its basis in common justice. The people of Minnesota are aroused over the action of the Western Federation of Miners in precipitating the strike without cause. The strike was declared not only in defiance of the season's contract but absolutely regardless of the strikers' own ultimatum. Regard for the rights of others is not to be expected from such a source, and the strike in the iron regions must fail through the sheer weight of the ignominy in which it is held.

The strike of the dockmen was merely a reflection of the general disorder stalking in the iron mines. The men voted to return to work on Thursday. In fact they had grown well weary of the idleness thrust upon them. Meanwhile ore shipments of course have fallen off greatly, but not so as to sensibly disturb the general state of industry. The great steel-making companies have during the past three years wisely brought down annually more than they can consume and are therefore well provided. Moreover, the lake fleet is capacious and the lake terminals the most efficient in the world. They are likely before the season is out to give striking evidence of their ability to handle a great volume of freight within a very short period of time.

A REALLY VALUABLE WORK.

That the MARINE REVIEW COURSE FINDER is a valuable work is only too apparent. Our book department reports many mail orders and these orders continue to arrive daily. We would advise those for whom the book is intended not to waste any time in waiting or making up their minds what to do. Get the book at once and get the benefit of it from the start. You will eventually get it; we are sure of this, because in our judgment we cannot see how any man sailing a boat can afford to be without such a useful and practical tool as our

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COURSE FINDER. It will do things for you that no other book on the market can do, and not only that it contains just the kind of information that engages your attention in the every-day navigation of your boat. The various bearing methods for finding off-shore distances contained in the work is worth alone the price of the book. These methods are something out of the ordinary, and are not the same old kind as published in nearly every work on navigation. They are all up-to-date and of real live value, and are the kind that can be used when most necessary—when the ship is in dangerous quarters and her safety depends on distance finding. The last portion of this book contains all the best known bearing methods known to navigators. We published only those that we knew to be of real practical value to the lake master. There is no other one book published that contains as many bearing methods as our publication. Do not delay but send in your order at once. The price is $2.50 carriage prepaid to any address.

SITUATION AT DULUTH.

Duluth, Aug. 1.—With all the charters at one cent and no other cargoes available the shipment of wheat and flax from the head of the lakes last week was very heavy. This was especially true of flax due to the big cargo taken out by the Hanna. Receipts remained about the same while the movement of other grains fell off. The figures for the week are given as follows:

	Receipts.	Shipments.
Wheat	744,844	1,333,766
Corn	3,021	25,410
Oats	93,918	1,883
Rye	9,234	4,773
Barley	85,816	82,207
Flax	200,155	1,093,190

A comparison with the figures for the same week a year ago indicate just how much the grain movement has been enhanced by the tieing up of ore shipments. The following are the figures for the week ending July 28, 1906:

	Receipts.	Shipments.
Wheat	198,012	626,134
Corn	6,701	294
Oats	312,509	315,575
Barley	150,365	62,526
Rye	5,881	......
Flaxseed	505,323	426,149

The new channel across the St. Louis bay leading to the dock of the Duluth, Missabe & Northern dock has been completed and is ready for navigation. With the resumption of shipping it will undoubtedly be in constant use as it will make the entrance to the docks and departure much more easy for the boats than it has been previously. The channel posts and lights are to be set at once.

During the forepart of the week several of the boats at Allouez were loaded by the captains and mates with passengers assisting in some instances but there is little available ore left in the dock and there seems to be no possibility of any more cargoes before the settlement of the strike. A few boats left here light for lower lake ports and coal cargoes among them the Earling, Clemson and Wells. The H. B. Smith went to Lake Erie light from Port Arthur for coal. The Steel Corporation is keeping its newer and larger boats moving but all the barges and an increasing number of the smaller boats are lying idle.

The strike of the ore handlers is settled, the men having voted to return to work on Aug. 8 on the same conditions that existed when they struck.

OBITUARY.

Capt. Samuel Dodd, for fifteen years master of the White Shoal lightship, died at Detroit last week.

Robert Greenhalgh, one of the oldest residents of Cleveland, died at the Masonic home at Springfield on Saturday last. Mr. Greenhalgh had seen Cleveland grow from a village to a great city. He built the first tug to be employed upon the Cuyahoga river at Cleveland and christened it Old Niagara. He was identified with the tug business of Cleveland for over forty years and it was he who conceived the idea of pumping sand from the bottom of the lake rather than taking it from the beaches. He retired when his business was absorbed by the Kelley Island Lime & Transport Co.

AROUND THE GREAT LAKES.

Capt. Frank C. Rae is at Superior looking after the fitting out of the steamer Ward Ames.

Mr. James Carey Evans, western manager of the Anchor line, has just completed a business tour of the lakes.

The directors of the Detroit & Cleveland and Detroit & Buffalo lines declared a semi-annual dividend of 4 per cent last week.

A new issue of $650,000 in ship building bonds is offered by the Detroit Trust Co. on the three freighters of the Weston Transit Co.

The name of the steamer Peerless recently bought by the Chicago-Muskegon Navigation Co., will be changed to City of Muskegon.

The burned hulk of the steamship Naomi has been towed to Johnston Bros. ship yard at Ferrysburg, Mich., where it will be overhauled.

The steamer City of Traverse has been purchased by the Graham & Norton line and will be used in the freight service between Chicago and St. Joseph.

The four Brown electric machines at Conneaut last week discharged 9,300 tons of ore from the steamer Hoover and Mason in seven hours and twelve minutes.

The owner of the steamer Henry Houghton has been fined $1,000 by the collector of customs of Detroit for failure to provide the life-saving equipment ordered by the steamboat inspection service.

The 230-ft. single span lift bridge of the B. & O. railway across the harbor slip at Cleveland was put in commission this week. It is is electrically operated and was built by the King Bridge Co. of Cleveland.

A. T. Kinney, of Cleveland, has purchased the steamer Iron King and the schooner Iron Queen from the Duluth & Atlantic Transportation Co., of Detroit. The boats have been managed in Cleveland by Capt. W. C. Richardson.

The Great Lakes Dredge & Dock Co. are making commendable progress in removing crib No. 1 outside of Cleveland harbor. It is expected that the crib will be entirely removed within a month, though one year was allowed the company to remove it.

The steamer Odonah, building for the Lackawanna Steamship Co., was launched at the Lorain yard of the American Ship Building Co. on Wednesday, July 31, and was christened by Miss Gean Haselton. The Odonah is 440 ft. over all, 420 ft. keel, 52 ft. beam and 28 ft. deep.

A. Heath Carr, who has been assistant to Capt. Philip Roderick, local manager of the Great Lakes Towing Co. at Cleveland, has resigned to enter the sales department of the Garlock Packing Co. at Cleveland. Mr. Carr is well and favorably known among vessel owners and shipping interests generally.

MISCELLANEOUS ITEMS.

The North American Dredging Co. have removed their main office from Bacon building, Oakland, to 718 Merchant Exchange building, San Francisco, Cal.

The Old Dominion liner Hamilton recently came into port at New York with a fire in her hold which required the flooding of that compartment before it could be extinguished. The damage is estimated at $15,000.

The Hudson River Day Line steamer Hendrick Hudson broke her rudder recently while trying to make a landing at Kingston Point and drifted helplessly down the river until tug boats came to her assistance. After unsuccessful efforts to repair the break the steamer was towed to New York.

The steamboat Frontenac was burned and beached on Cayuga lake, July 27, eight lives being lost in the disaster. The fire started in the engine room and spread to the after part of the boat. As the steamer was beached many jumped overboard into water too deep to wade ashore and thus were drowned.

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LAKE SHIP YARD METHODS OF STEEL SHIP CONSTRUCTION.

BY ROBERT CURR.

Fig. 2 shows the lines of the vessel faired up on a quarter inch to the foot scale. The sheer plan, body plan and half breadth plan here shown represents the problem of fairing up a vessel.

The sheer plan is the first to be considered, the base line is run in and the frame lines erected perpendicular to same. The water lines are run in parallel to the base line then the spar deck line at center is determined and all the longitudinals on the shipside are run in parallel to the spar deck with the exception of the tank top which is considered by itself.

The ending of the shell plating is also considered and a line is run in forward and aft on the stem and stern post which is termed the bearding line. This line determines the knuckle for the shell plating which ends on the stem and stern post.

The lines used in fairing up a vessel are base, frames, level, deck, longitudinal and buttock lines as shown on the three plans.

The lines shown on these plans are lines at side of vessel except at ends which are at center.

The half breadth plan is faired up and the lines transferred to the body and sheer plans until the three plans coincide.

The frames are spaced three ft. apart amidships and closed up at the ends.

The water lines are spaced two feet apart and numbered 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 and 12. The buttock lines are spaced 4 ft. apart except No. 1 which is spaced two ft. from the center line and only used in the after body. After the vessel is faired up as stated a model is made and the shell plating faired up on same and transferred to the body plan.

From these lines plans are made for the different parts of the vessel and the material all ordered from the office.

It is usual for all the material to be in the ship yard prior to commencing the construction of the vessel.

Fig. 3 shows the stem, Fi. 4, the stern post and Fig. 5 the rudder and details. These plans are part of the details in fairing up the vessel and are usually determined before the fairing up of the vessel is gone on with.

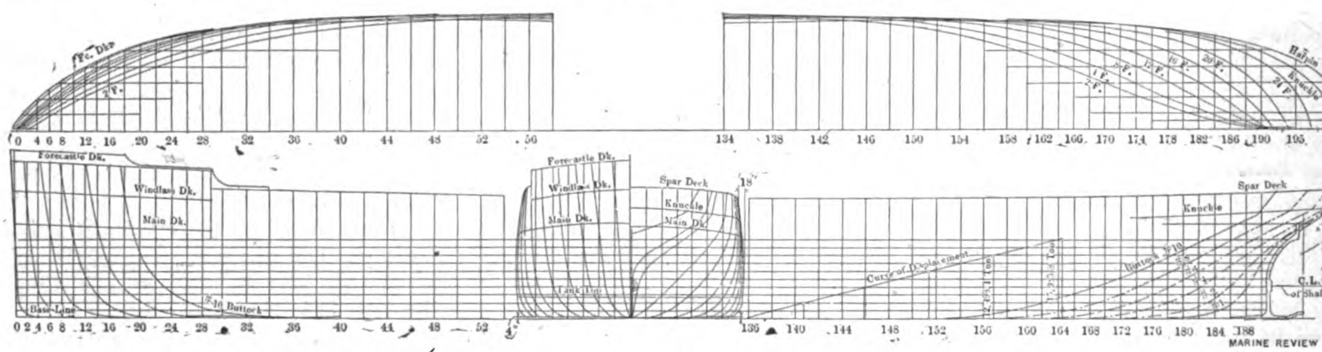

FIG. 1.

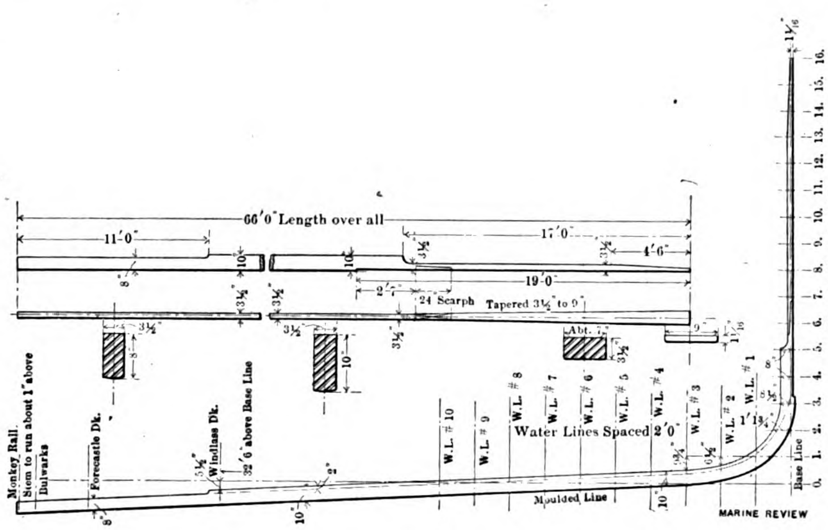

FIG. 2.

ORDERING MATERIAL.

This vessel being built on the mold system the bottom shell plating is the first material to be considered in ordering from the mill.

The keel plates, A strake, B & C strakes and D are ordered for the straight part of the bottom of the vessel and it is seldom that any shearing is done on these plates. On the side of the vessel owing to the plate edges following the sheer, it is necessary to allow at least half an inch on the width of the plates for shearing to get a nice line on the ship's side. All the shell plating amidships is ordered from the midship section, the balance when the model is completed and plate lines faired up. The center keelson and girder plates are next considered which are ordered a little scant to save shearing.

The deep floors are ordered from blue prints and come into the ship yard a little less in size to save shearing.

Molds are made for the bilge or futtock plates also the brackets connecting the floors to the center keelson and sent to the mill. The plates are cut at the mill and sent to the ship yard the actual size which saves shearing these plates in the ship yard.

Where the futtocks change shape they are scratched in on the midship mold and cut to the lines so that the bracket plates at the ends of the vessel do not require shearing any more than the midship pieces.

All brackets throughout the ship are treated in the same manner, thus reducing the amount of scrap on the vessel very considerably. All the other materials are ordered in the

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usual way being numbered and lettered for the parts of the vessel which they belong.

LAYING OFF.

Table A shows the offsets of a vessel which are the carefully measured distances of the frames from the center line on the water lines, also the height of the decks and widths of same from the faired up lines on the quarter of an inch scale.

These offsets are laid down on the floor to full size and with the plans of stem, stern post, transom framing and order of materials about completes the data given to the loftsman.

He goes to work by first laying down the sheer plan including the stem and stern post to full size. The body plan is next proceeded with.

The body plan is usually laid down at the end of loft floor best suited for light. One half of the fore and after bodies being used only for this purpose.

The center line and half molded width at side, rise of bottom, half of stem and stern post, position of buttocks, bow and water lines.

The width of the frames are measured and marked on the water lines and battens held on the marks until compared with the half breadth plan and sheer.

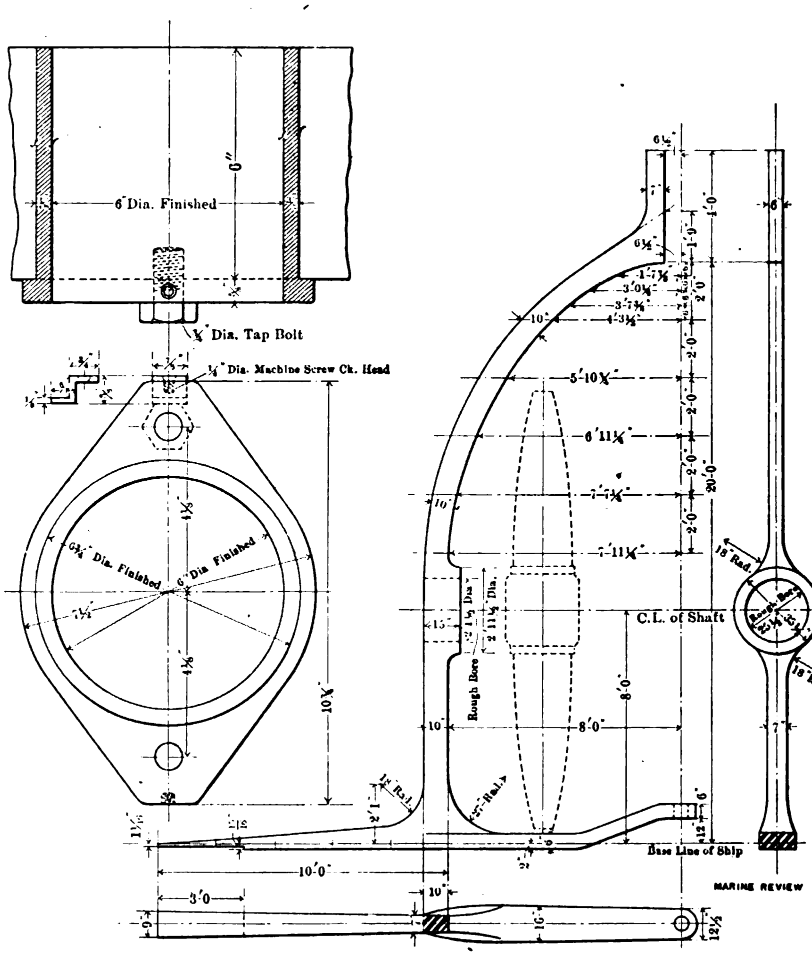

FIG. 3.

TABLE "A."

Half Breadth of Water Lines.

Frames.	1-ft.	2-ft.	4-ft.	6-ft.	8-ft.	10-ft.	12-ft.	14-ft.	16-ft.	20-ft.	24-ft.
Stem	0- 2-5	0- 2-2	0- 2-0	0- 1-7	0- 1-7	0- 1-7	0- 1-7	0- 1-7	0- 1-7	0- 1-7	
2		0- 2-2	2- 6-0	3- 9-3	4- 7-5	5- 2-4	5- 9-0	6- 1-5	6- 5-5	7- 0-2	7- 5-5
7	3- 3-3	5- 2-0	7- 3-4	8- 7-5	9- 7-5	10- 4-4	10-11-4	11- 5-0	11-10-5	12- 6-6	13- 2-0
12	7- 9-1	9- 6-6	11- 9-4	13- 2-7	14- 2-2	15- 0-3	15- 7-4	16- 2-0	16- 7-2	17- 3-1	17- 9-5
16	11- 7-5	13- 5-0	15- 8-3	17- 0-5	18- 0-5	18-10-0	19- 4-0	19- 9-5	20- 2-0	20- 8-0	21- 0-4
20	15- 0-5	16-10-5	19- 0-4	20- 3-5	21- 2-0	21- 9-5	22- 3-0	22- 7-1	22-10-4	23- 3-0	23- 6-0
24	18- 1-0	19-10-0	21- 9-5	22-10-0	23- 5-7	24- 0-0	24- 4-3	24- 7-0	24- 9-4	25- 0-3	25- 1-2
28	21- 4-2	22-11-1	24- 4-7	25- 0-4	25- 6-2	25- 9-3	26- 0-2	26- 1-6	26- 3-4	26- 4-4	26- 5-4
31	23- 5-3	23- 8-2	25- 9-7	26- 3-2	26- 8-0	26- 9-5	26-10-2	26-11-1	27- 0-0	27- 1-0	27- 1-6
34	25- 2-5	26- 2-0	27- 1-3	27- 3-6	27- 6-0	27- 7-0	27- 7-0	27- 6-4	27- 6-2	27- 5-4	27- 4-2
37	25- 9-2	26- 8-3	27- 6-4	27- 8-2	27- 8-4	27- 8-5	27- 9-0	27- 9-3	27- 8-5	27- 7-5	27- 6-0
40	26- 3-4	27- 2-0	27-11-0	28- 0-0	28- 0-0	28- 0-0	28- 0-0	27-11-4	27-10-7	27- 9-0	27- 6-4
50	26- 6-0	27- 4-7	28- 0-0	28- 0-0	28- 0-0	28- 0-0	28- 0-0	27-11-4	27-10-7	27- 9-0	27- 6-4
146	26- 2-4	27- 1-4	27-10-6	28- 0-0	28- 0-0	28- 0-0	28- 0-0	27-11-4	27-10-7	37- 9-0	27- 6-4
147	25- 8-0	26- 6-2	27- 3-6	27- 8-3	27-10-2	27-11-0	27-11-5	27-11-0	27-10-3	27- 8-4	27- 6-0
152	24- 8-5	25- 7-7	26- 7-5	27- 2-6	27- 6-0	27- 8-2	27- 8-7	27- 9-0	27- 8-7	27- 7-0	27- 4-6
155	23- 4-2	24- 5-2	25- 8-0	26- 5-4	26-11-4	27- 2-1	27- 4-5	27- 5-2	27- 5-1	27- 3-2	27- 1-0
158	21- 6-1	22-10-5	24- 5-0	25- 5-4	26- 1-3	26- 6-0	26- 9-7	27- 0-0	27- 1-0	27- 1-5	27- 0-5
161	19- 1-5	20-10-2	22-11-0	24- 1-7	25- 0-0	25- 6-6	26- 0-0	26- 3-0	26- 5-0	26- 6-0	26- 6-2
164	16- 1-4	18- 4-2	20-10-3	22- 5-2	23- 7-5	24- 4-0	24- 4-0	25- 4-0	25- 2-3	25-10-7	26- 0-0
167	12- 3-6	15- 3-0	18- 3-0	20- 2-5	21- 7-5	22- 8-3	23- 5-5	24- 1-0	24- 6-1	25- 1-0	25- 3-5
171	8- 8-0	12- 0-0	15- 5-0	17- 7-2	19- 4-5	20- 7-5	21- 8-0	22- 5-5	23- 2-5	24- 0-0	24- 5-5
175	5- 4-3	8- 5-3	12- 1-6	14- 8-0	16- 7-6	18- 1-6	19- 5-1	20- 5-2	21- 5-2	22- 7-4	23- 6-0
179	2-10-0	5- 1-0	8- 7-0	11- 3-0	13- 4-0	15- 1-4	16- 8-0	18- 1-0	19- 2-2	20-10-5	22- 2-0
183	1- 6-0	2- 9-0	5- 2-5	7- 4-0	9- 5-0	11- 4-5	13- 1-5	14- 9-0	16- 2-5	18- 8-0	20- 5-2
187	0-10-2	1- 4-5	2- 7-2	3-11-0	5- 5-0	6-11-0	8- 8-2	10- 5-0	12- 0-2	15- 6-0	18- 3-0
191	0- 5-5	0- 7-4	12- 0-2	1- 5-3	2- 2-1	2-10-1	3-11-1	5- 2-0	6- 9-4	10- 8-4	14- 8-0
195	0- 4-0	0- 3-0	0- 3-0	0- 3-0	1- 3-0	0- 2-4	0- 2-4	0- 2-4	0- 2-4	2- 8-4	8-10-0

Heights.

Frames.	Forecastle Deck.	Main Deck.	Spar Deck.
Stem			37- 0-0
7	8 ft. above spar deck	10' 6" below spar deck at side	36- 3-3
16			35- 7-5
24			35- 0-2
30			34- 5-5
35			34- 0-1
40			33- 6-0
45			33- 1-0
50			32- 8-7
55			32- 5-5
60			32- 1-3
65			31-10-4
70			31- 7-7
75			31- 5-3
80			31- 3-5
85			31- 2-3
90			31- 1-5
95			31- 0-6
100			31- 0-0
117			31- 0-4
127			31- 2-4
137			31- 5-7
147			31-10-5
157			32- 4-4
167			32-11-1
177			33- 4-7
187			33-11-5
192			34- 3-5
195			34- 6-5
198			34- 9-6
Stern			35- 6-0

Knuckle 4-2¼ below spar deck.
Rail 3 feet above spar deck.

Half Breadths.

Frames.	Spar Deck.
Stem	0- 1-2
7	14- 5-2
16	21- 9-5
24	25- 4-1
30	26- 8-1
35	26-11-4
40	27- 0-0
152	26-11-0
157	26- 7-7
162	26- 2-0
167	25- 5-0
172	24- 9-6
177	24- 0-0
182	22-11-3
187	21- 5-6
192	19- 5-6
195	17- 9-5
198	15- 3-6

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All straight lines are drawn in on the floor before proceeding to locate the curved lines on all plans.

Battens for the curved lines are left on the floor until all the plans agree which saves the trouble of rubbing out lines on the floor and the fairing up of lines can be more readily arrived at by this method.

More care is necessary in laying off when the vessel is practically laid off from the mold loft floor.

The lines are all carefully and thoroughly faired by reference to the three plans so that very little trouble is experienced when the work is erected.

The midship part of the vessel may be gone on with even if the lines are not faired up if the midship section be determined.

It is certainly easier for the loftsman if he is done with the fairing up of the lines so that he can get out his molds for the construction which needs all his attention.

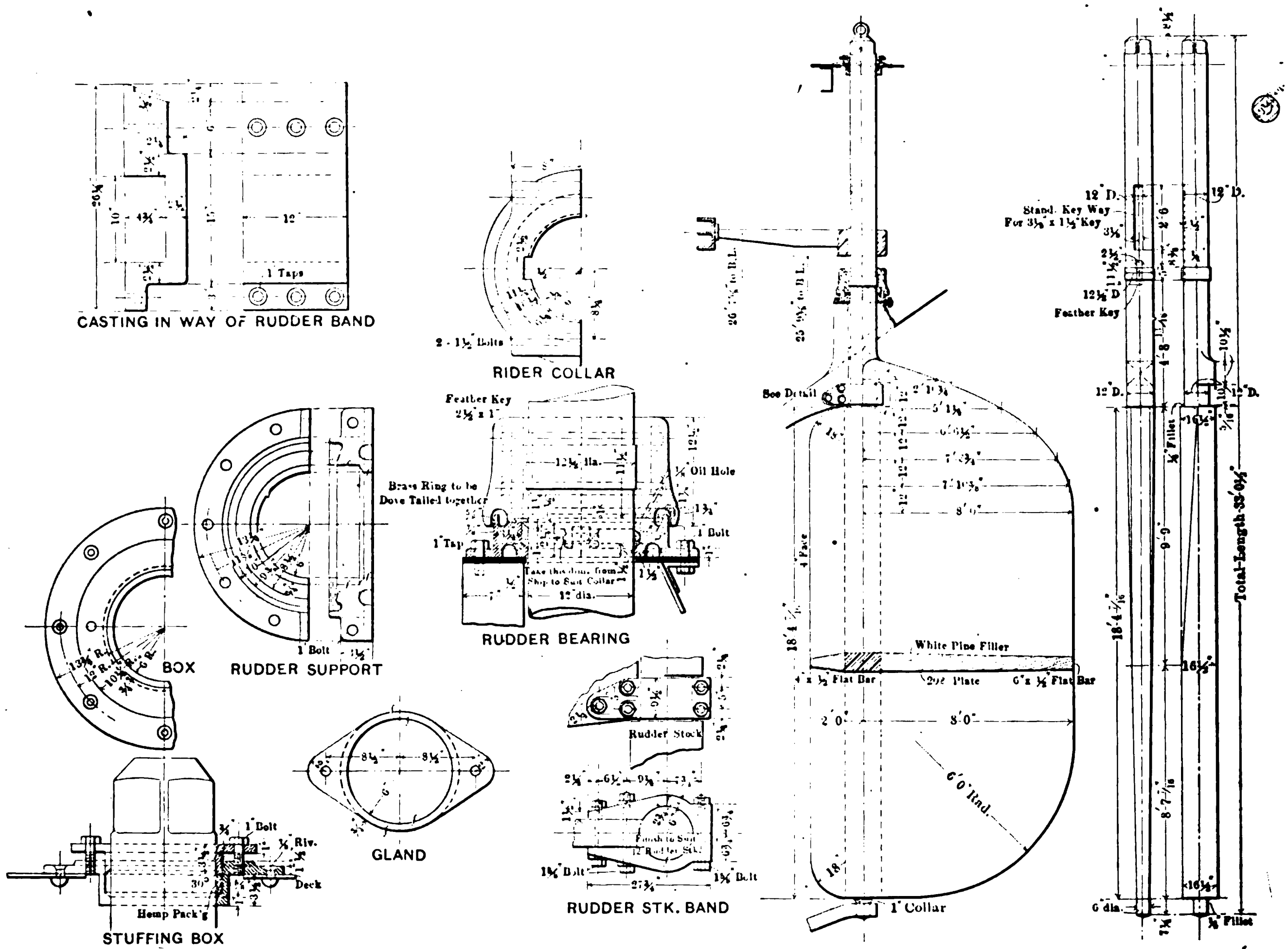

FIG. 5.

The freighter Charles O. Jenkins left Detroit on her maiden trip July 29.

"IN THE MERCHANT SERVICE"

The chief engineer made his way along the promenade deck, occasionally side-stepping to clear one of the many chairs littered around, a nursemaid playing with a child, or a steward skipping about with a trayful of light refreshments. The presence of the Gulf Stream and the pitiless glare of the midsummer's sun had been too much for the merry shuffleboard players, and even promenaders were few. Aft, somewhere, the ship's band was blaring through the latest thing in popular melodies, the perspiring bandsmen surreptitiously mopping their faces at intervals. The passengers, packed away in the rows of chairs under the awnings, lolled around listlessly, staring at the oily surface of the ocean. "Glorious day, Mr. Gunn," said one of the regular patrons of the line. "It is a glorious day," responded the chief, "up here," he might have added.

"Good morning, Mr. Gunn," said the captain, as the chief engineer arrived at his stateroom, "how are things in your department this morning?"

"Worse than ever," answered the engineer; "this weather is bowling the men over like nine-pins. The fire-rooms are away up about one-forty degrees—regular ovens—and there isn't a breath of air three feet from the ventilators. These new men of ours can't stick it, and, unless a saving breeze springs up, I'm afraid we'll make some poor running."

The captain shook his head sympathetically. He and the chief had risen together from seventh mate and twelfth engineer, passing from the oldest and slowest ships of the line, by stages, to this—the newest and swiftest—with the reputation of being a "holy terror" below, and close friendship had educated the mate in the knowledge of the engineers' troubles.

In the "office" they might accept heavy weather, a breakdown, or even bad coal, as an excuse for a slow passage, but overheated fire-rooms

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and a sickly crowd of men—pooh—nonsense.

Down in the fire-rooms the scene verified the words of the chief engineer. The heat was awful. Stripped to the waist the firemen toiled at the furnaces, the perspiration trickling down their grimy skins. There was none of the cheerful slamming of furnace doors and rattle of fire-tools, the men working mechanically and half heartedly. Others, awaiting their turn at the fires, crowded under the ventilators and in the wings of the boiler-rooms, getting what little air there was drifting down the sixty feet of air shaft. The engineers, in their sweat-soaked boiler suits, passed from one fire-room to another, alternately coaxing and cursing the laggards.

At intervals an engineer goes for'ard to the fo'c'sle to hunt back some men who have in desperation deserted their fires and bunkers, and the men, pleading for a "watch off" stumble back to their posts. Occasionally a fireman collapses in front of his furnaces, and lies writhing and grovelling in the grip of the much-dreaded cramps. His mates drag him clear of the smouldering char and carry him to the wing. At a sign from the engineer a coal-passer finishes the fireman's turn at the furnaces, the sympathising mates—who have taken advantage of the momentary confusion—being gruffly ordered to go ahead on the fires.

In the early evening the doctor's man tells a junior engineer that one of the firemen is not expected to live overnight, and at midnight the carpenter is building a coffin.

At 2 a. m. two sailors are sent below for fire-bars. "Take these broken bars," says the Third Engineer, "we never waste good bars on a funeral."

At daybreak some sailors carry the body along the deck and lay it on a plank projecting over the water. Perhaps another bar is advisable and the lid is pried off the coffin to permit the adding of the extra weight. Perhaps it is noticed that the dead man is still in his grimy clothes. Who cares? The captain steps from the saloon door and begins the reading of the solemn funeral service. A few steerage passengers and such of the crew as are interested draw respectfully near. At a sign from the mate the plank is tilted and the coffin slides out from under the flag. The engine, which has been slowed momentarily, is again set away, the sailors go forward with the plank and the flag, and the crowd disperses.

"TAKE THESE BROKEN BARS," SAID THE THIRD.

A brisk wind is blowing and a good day's run is prophesied.

"Well, the weather is freshening up," says the man in the deck chair, "but yesterday was a glorious day."

"The weather is freshening up," says the man on the fo'c'sle form, "yesterday was hell."

THE "STAND-BY" MAN.

The second of the British Dreadnoughts, the Bellerophon, was launched July 27 at Portsmouth. The Bellerophon is, however, the embodiment of several improvements over the original. She has a tonnage of 18,600, which is 700 more than the Dreadnought. The Temeraire, the third of the class, will be launched the latter part of this month.

IN THE GOOD OLD SUMMER TIME.

BY JAMES ROSSAN.

The place was Lake Erie, and the time was the ides of August. Naked to the waist and dripping with perspiration Casey stood in front of the glowing furnaces down in the depths of the Magnolia.

The day was one of those sultry summer days when the heat raises the paint on deck in huge blisters, and a Paddy's hurricane drives the black pall of smoke straight in the air, from whence it falls back again involving the ship in a hazy cloud.

Gasping for breath Casey looked longingly up to the place where the ventilators ought to be, but were not. Then he relieved his pent up feelings with a, "Take that, curse ye!" as he made a vicious lunge with the shovel at a red-hot clinker which had ignited the frayed end of his trousers. He was not granted long for reflection on the misery of his condition, for the steamgauge was dropping and there was plenty to do prying the huge clinkers from the gratebars. On days like this the Magnolia's draft was represented by zero and those stubborn clinkers grew like mushrooms, in spite of Casey's working and sweating and fuming and cursing.

Never did Trojan work as he, for the stake was a tremendous one. Upon the holding of that gauge depended his reputation among his fellow compeers. He was not of the bending kind. Hardy son of Erin that he was, he could not crawl under obstacles, but, from the very composition of his nature, he must ride over them. So he worked, and worked, and worked; and shoveled, and hooked, and sliced in spite of the fact that he was violating one of natures laws which says that for the combustion of a certain amount of coal a certain amount of oxygen is necessary. And consequently the gauge kept going down.

"Curse ye, for a mankiller!" Casey spat out again, as he wiped streams of salty perspiration from his face. "Sure, is there no way to make ye steam at all, at all? Upon me sowl, I belave ye're chockin' for a bit o' wind. Chockin' for a bit o' God's fresh air, even as poor Casey, the stoker is."

"Right ye are Casey!" came a voice from overhead. It was no less a person than the captain himself, who spoke. "Nary a bit o' sinse is there in a man working in a place like that," he continued. "Take it easy a bit, Casey, and I'll show ye what a man with a brain can do. Sure, it must be hell down there; and the bloody galoot what built this stokehold ought

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to be servin' a sintince in jail. But, moind ye, Casey, I'm not a man as will stand for it, not I. I'll cut the whole bloomin' top of her before I'll boil the heart out of a man like that. Let it out, that's my idea of it. Give it a chance to get out and the fresh air 'll get in, that's the scientific way of it."

Poor Casey could hardly belive his own ears, but the next moment a hammering, and cutting and riveting overhead gave him the surprise of his life. And soon two great hatches opened up on top. They were not little dinky scuttles, but big hatches six by eight. The measly two inch opening around the stack, half choked by the crazy little apron, was opened out to at least two feet.

Next the chief engineer appeared on the scene. He was a man who had been up against knottier problems than the skipper and had grown cynical. He shook his head at it all, and said: "The way to get anything in a certain place is to put it there. But I'll give you air, Casey, you can depend on that."

Then a big fan was installed in the engine-room, with a ten-inch pipe leading directly to the stokehold. Casey nearly jumped out of his skin as the cold blast of it struck his naked body. He stood in front of it and inhaled great deep drafts, which put new life and vigor into him.

"Faith, it's no trouble for a man to work if he has a bit o' air for his lungs," he said. "Begorra, now I'll put that crazy owld gauge around four or five times and thin I'll blow the blamed thing up."

But it required no effort from the stoker. With a good supply of fresh air in the stokehold the gauge was climbing of its own accord. Up, and up, and up it went. Casey closed the dampers and eased the doors back. Ever higher went the gauge, and the safety valves began to hiss and spit.

"Oh, the heartache of it all," said Casey, as he sat down contentedly in front of the cold blast. "To think how she's been boilin' the liver out o' me. And now she's cool as paradise and the fairies are pullin' the gauge up."

He strove with all his might to prevent her from blowing off. But ever louder roared those safety valves, and finally they let go with a bang. For a moment it was pandemonium turned loose. All things roared, all things whirled rapidly in confusion, and then came to a sudden stop with a short, sharp jolt.

Casey opened his eyes, gazed about him in bewilderment, and finally awoke to the realization of the fact that he was laying flat on his back on a cot in the Marine Hospital. Beside him stood two grave faced surgeons, while two uniformed attendants were busily plying their fans.

"What a physique," said the older of the doctors. "Over two-hundred pounds, and not an ounce of surplus flesh and every muscle as hard as a rock. I doubt if the rigors of Spartan training ever produced the likes of this."

"And what a boat it must be to do him up as he is done," said the younger of the two, as Casey's body doubled up in convulsions, and the big, blue bloodveins swelled to the bursting point.

The chief surgeon ordered the application of more ice, as he shook his head gravely and said: "The danger lies not as much in the cramps as in what follows after. This man is in th throes of a high fever now.

Snow was flying up on Lake Superior ere Casey left the hospital. And, somehow, he could never find courage to tackle a stokehold any more. He said the heart was boiled clean out of him. But for weeks before Casey left, the Magnolia kept adding her regular quota to the patients of the hospital. The old surgeon shook his head indignantly and decided on a personal investigation.

A short examination told the tale. The decks of the crazy old floating coffin had been raised above her original boilerhouse, thus eliminating all possibility of fresh air getting near the place. No ventilation had been provided, and absolutely no outlet existed for the escape of the hot gases. Consequently that murky stokehold was a reeking hellhole of heat and a filthy breeding place of disease.

The old surgeon met the skipper on deck and explained to him. But that dignitary assured him that it was entirely beyond his jurisdiction. Anything below decks did not concern him in the least.

Next the chief engineer was found, and after due explanation and brief statement of causes and effects the man of medicine ventured the suggestion of remedies.

"A fan," he said, "would be a lifesaver and even a couple of small ventilators would do a world of good."

"Yes," the chief engineer answered. "I presume you are right. But then, you see, those things cost money and the owner tells me that this boat is not paying expenses."

And then the surgeon knew that he was up against a disease for which he had no remedy. But, as he left the boat he clenched his fists and muttered to himself: "It is a shame that there is no law for it. If there was you can bet that someone would be made to toe the mark."

ON SEA AND SHORE.

A London paper, in an article on the sea as a profession, says: "If a boy has a liking for mechanics, he would be well advised to become a marine engineer. It is true that at first he would have a very hard time of it indeed, but when he rises to be chief engineer on a large ship he will have practically nothing to do but direct the efforts of his subordinates."

* * *

It is said that the throbbing and vibrations of the engine on a modern steamer have a most extraordinary effect on the human heart. The vibration is transmitted to this vital organ with the most extraordinary results as far as the medical examination is concerned. Through the stethoscope it seems as if every moment the heart would stop. Still, it is some comfort to know that this is considered beneficial.

* * *

One of the leading wireless companies has been untiring in its efforts to span the Atlantic Ocean, and recently some experiments have demonstrated to the satisfaction of the experimenters that the feat is entirely feasible. A station is about to be established at Clifden, on the west coast of Ireland, and it is expected to establish direct communication with the United States. At the new station an innovation will be tried in the shape of metal plates to launch the etheric impulses into space instead of a latticework of wires, which have been generally made use of heretofore.

* * *

That fortunes can still be made in whaling is shown by the records of Capt. Horace Smith, of the whaler Josephine, who recently arrived at New Bedford after a 21 months cruise in the Indian Ocean. The Josephine brought in 30 casks of sperm oil, 5,000 barrels of whale oil, and 12,000 pounds of whale bone.

* * *

A correspondent in the *New York Herald,* writing from the steamer Taunton, complains of the disreputable sewerage system adjoining the dock to which the steamer tied up at Brooklyn. He adds. "When we arrived here we had left Calcutta some

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eighty days previously and Philadelphia was one of our ports of call. No sickness was experienced by any member of the crew. However, the New York health authorities decided that as Calcutta was an infectious port the vessel had to be fumigated. What, may I ask, is the use of the health authorities taking these stringent measures to prevent disease coming into port when they breed it right here themselves by allowing such a disgraceful state of neglect to remain?"

* * *

Passengers of the steamship Chodoc, who had hoped for compensation for being wrecked on the coast of Somaliland, suffering from the climate and being robbed of their baggage by natives, have been disappointed by the decision of the French law courts. The Chargeurs Reunis Company put forward a clause, printed on their tickets, that the company was not responsible for mistakes of captains. The court decided that the clause holds good and refused compensation.

* * *

There is on exhibition in a clothing store at Bath, Me., the tusk of a mastodon weighing close on 100 lbs. It is a splendid specimen, was found imbedded in ice by an Esquimo Indian and traded to Capt. H. H. Williams for a bag of flour. The captain got a bargain, certainly, but the Esquimo couldn't eat the tusk.

* * *

Baron Herold, a wealthy Pomeranian land owner, has offered the German government to equip at his own expense a ship to study atmospheric conditions in the Polar regions. A vessel adapted to the purpose has been found and fitted out and is equipped in a very complete manner. It has a small balloon with a windlass and a self-registering apparatus to determine the conditions of the air in the upper strata. It has left Kiel for the North.

* * *

A modern incandescent lighthouse lantern with a 3½-inch mantle gives 2,400 candle power, and uses no more oil than the old 6-inch wick burner which gave only 700 candle power.

* * *

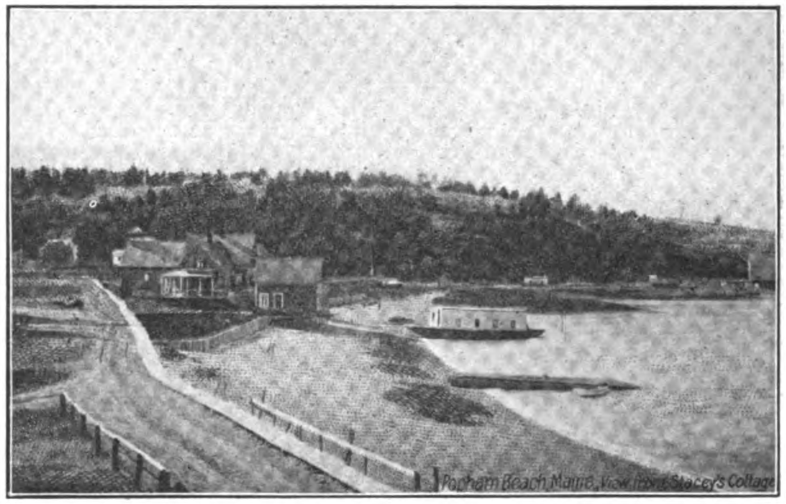
He ticks the carbureter
  And he emerys the switch,
He fumbles with the wiring,
  Making sure that which is which.
With the needle valve he fusses,
  On his knees he cranks and cusses,
The spark coil softly buzzes—
  And she's off.

—*The Gasoline Engineer.*

TER-CENTENNIAL OF AMERICAN SHIP BUILDING

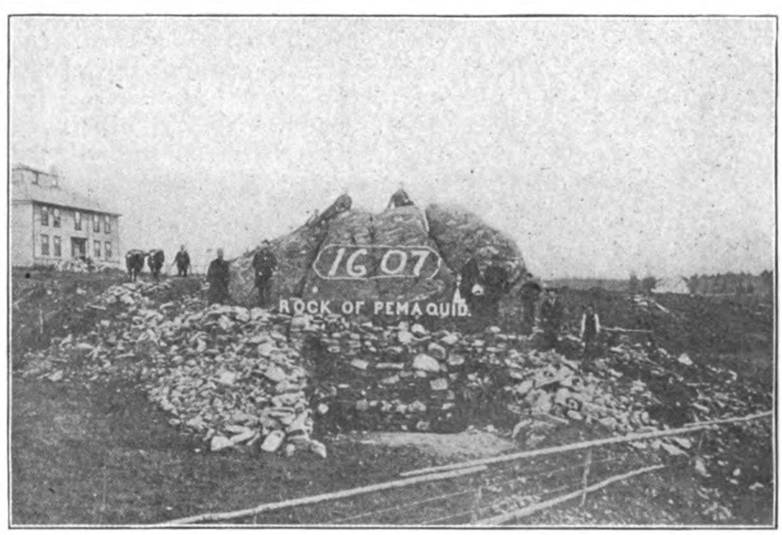
Bath, Me., is preparing to celebrate the ter-centennial of American ship building early in August, and for a week the otherwise modest little city will be the center of festivities. Popham is rich only in scenery and historical lore.

In 1607 two lumbering craft swung at their anchors off the mouth of the Kennebec while the voyagers, 120 in



SITE WHERE THE FIRST SHIP WAS BUILT AT BATH.

Though the first ship built on American soil was constructed at Popham beach, about 12 miles from Bath, it is but fitting that Bath, with its long and glorious record of ship construction, should rise to the occasion and make the celebration a national event. Popham of today is but a beautiful summer resort, with numerous cottages and camps lining its wide stretch of sandy beach. Here it number, under the leadership of Captain George Popham, made a landing and prepared to found a settlement. In due time the settlement was established and consisted of about fifty houses, a church, storehouses, and fort mounting twelve guns. Soon the work of building the stout ship, designed to cruise the coast and gather rich cargoes for England's markets, was commenced, the settlers



RUINS OF THE OLD FORT.

was, however, that a fort was built during the early wars of the United States, and later, on the same site, a granite fort of the Civil War period, which still remains to guard the towns of the Kennebec valley. working with a will as they thought of the fortunes the venture held in store for them. Sad to say, the death of the leading spirit, George Popham, was the signal for general wrangling and disagreements. The

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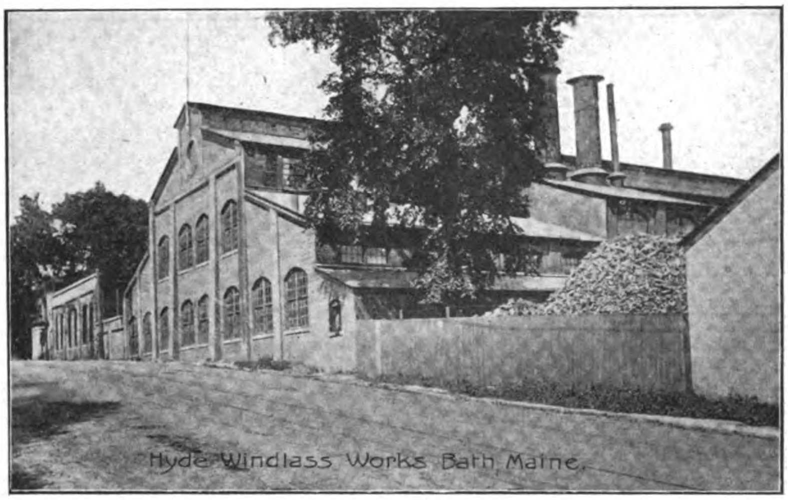
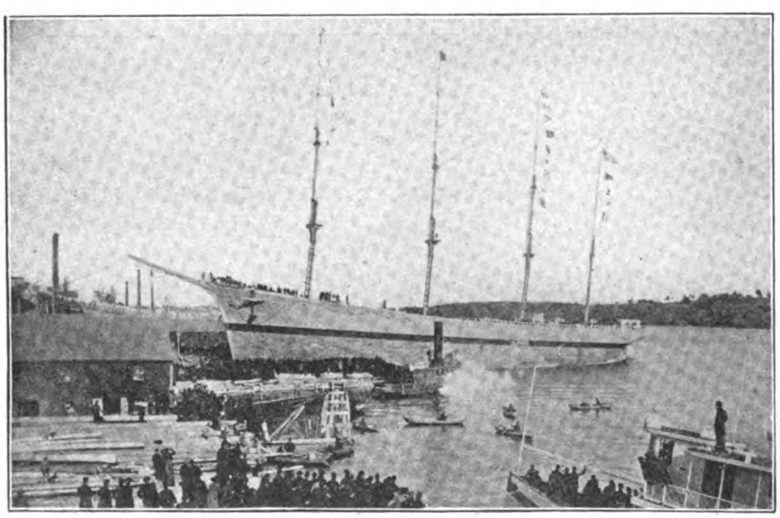
Indians, hitherto held in check, swooped down on the disorganized settlement and were eventually driven off with great loss of life. In the attack the storehouses were destroyed, and, with other of the buildings, burned to the ground. Winter came along with its bitter, biting wind and heavy snowstorms, and the settlers,



PLANT OF THE HYDE WINDLASS CO., BATH, ME.

with little or none of the necessities of life, gradually died off. The disheartened survivors, broken in health and spirits, boarded their ship, the Virginia, and set sail for England, leaving the settlement to the tender mercies of their foes.

However, the land was too rich in vegetation and fur-bearing animals to be long left in the hands of the original inhabitants. Other shiploads of



LAUNCHING A STEEL SHIP AT THE PLANT OF ARTHUR SEWELL & CO., BATH, ME.

pioneers arrived and settlements sprang up along the coast. The surrounding land was cleared and cultivated. The natives, with pardonable perseverance, again and again attacked the settlements, but, eventually deciding that the encroaching white man was peaceable and inclined to trade, suspended hostilities for a time. From then on the development of the land advanced, though an occasional outbreak of the Indians with a real or fancied grievance made the advance rather spasmodic. During this period all manner of craft were built to meet the needs of the settlers, an occasional ocean-going vessel being among the number. With the increasing settlements and towns shipyards began to appear along the coast, there being several large yards in full swing at the outbreak of the Revolutionary War, and the first naval vessel built in the New World being launched at Bath in 1783. Since that date over one million tons of shipping have been launched there. Many of the old Bath yards are matters of history now, new yards having risen to replace them.

Today there are a round dozen of shipyards at Bath and vicinity, all, with the exception of the Bath Iron Works and Sewall's Yard, being engaged in the construction of wooden-hulled sailing vessels and barges only.

In the MARINE REVIEW of this week is a description of the Bath Iron Works, the only yard in the state of Maine engaged at present in the construction of steel vessels. This yard launched in June the fast scout cruiser Chester. Here also was built the magnificent battleship Georgia. They now have on the ways the sister ship of the turbine steamer Camden. This concern grew by various stages from a small iron foundry to windlass and marine machinery constructors, thence to the present splendid yard. The founder and master mind which engineered the advance of the concern was General Thomas W. Hyde, who purchased the original foundry at the close of his services in the Civil War.

Foremost among the remaining yards may be mentioned that of Arthur Sewall & Co., with an honorable record of nearly one hundred years of ship building. In late years this firm has undertaken the construction of steel sailing vessels, a new departure in the Maine yards, the majority of such craft flying the American flag having been built at Sewall's yard. The yard of the New England Company, founded by Capt. Guy C. Goss and Elijah F. Sawyer, lies adjacent to Sewall's yard and has a record of over three hundred vessels to its credit. It has under construction at present a four-masted schooner. The Kelley Spear Co., which has an enviable record for constant employment, has three or four vessels on the stocks at present, its yard presenting a busy spectacle. Percy & Small, with a world-wide reputation for building the larger class of wooden vessel, are at work on two vessels of five and six masts, the latter with a capacity of 5,500 tons. The G. G. Deering Co., founded by Gardiner G. Deering, whose ship building experience extends over half a century, is adjacent to the yard of Percy & Small and is building a four-masted schooner. In addition to these are the yards of Houghton Brothers, the William T. Donnell, the William Rogers'. At Phippsburg are the Frank S. Bowger and the Minnott Yards.

In speaking of the firms engaged in the construction of marine and other machinery, the Hyde Windlass Co. needs no introduction. Its make of windlass and capstan is known throughout the shipping world, and the bustling appearance of the works today is proof of the ever-increasing demand for this type of ship equipment. The various shops are large and roomy, splendidly laid out, and

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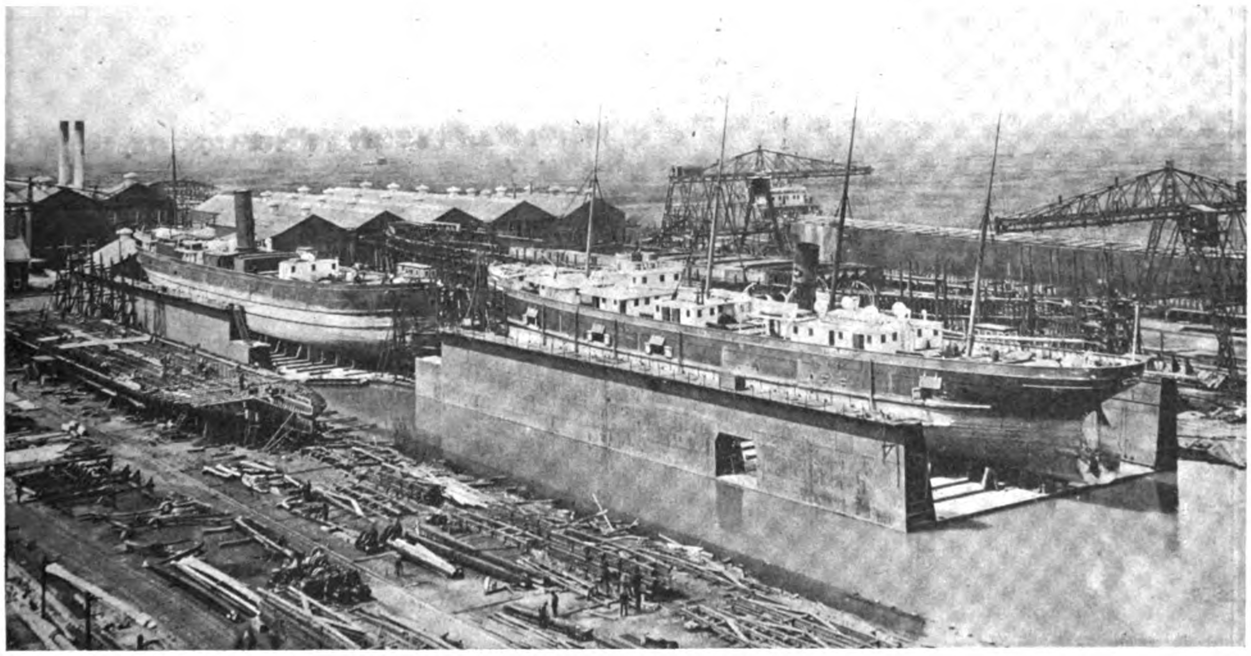

A STRIKING PHOTOGRAPH SHOWING THE GREAT FLOATING DRY DOCK OF THE GREAT LAKES ENGINEERING WORKS AT ECORSE, UNCOUPLED, WITH THE STEAMERS MARYLAND AND TUSCARORA, EACH OCCUPYING A SECTION.

are adjacent to the Bath Iron Works.

In addition to the Hyde Windlass Works, there are many smaller firms at work on the building and repairing of marine machinery. Many of these, again, confine themselves to gasoline engines and other motors, the Bath Marine Construction Co. having built and engined some of the finest motor craft afloat today. In Bath and vicinity there is an estimated fleet of five hundred motor boats, ranging from the diminutive dory to the largest cabined passenger craft.

To celebrate this—the three hundredth — anniversary of American ship building, the prominent townsmen, backed by the ship building and engineering concerns, have arranged committees to handle the various items in the elaborate program of a week's festivities. There will be the usual dress parades——military, naval and civil—by daylight and torchlight, water carnivals, automobile and motor-boat processions, and all that pertains to events of this nature. It is expected that many prominent statesmen, army and navy officials, and a considerable number of civilians, will participate in celebrating the glorious event.

ADAPTABILITY OF FLOATING DOCKS.

The photograph printed herewith, showing the steamers Tuscarora and Maryland in the floating dry dock of the Great Lakes Engineering Works at Ecorse is very interesting as it reveals very clearly the adaptability and economy of this form of structure for repair work. The Tuscarora and Maryland collided bow on at Port Huron with the result that the bows of both vessels were badly smashed from keel to bulwarks, necessitating new stems in each case. The dry dock measures 600 ft.; the overall length of the two steamers is about 650 ft. The dry dock was uncoupled into two sections of 300 ft. each, the Tuscarora being placed in one section and the Maryland in the other. In the photograph the Tuscarora appears in the foreground and the Maryland with her pilot-house, texas and forward cabins stripped, appears in the background. The two sections of the dock were brought together so that the bows of each vessel overlapped. Therefore repairs are being made on the bow of the Maryland by workmen stationed in the dock in which the Tuscarora lies while the repairs on the bow of the Tuscarora are being made by workmen stationed in the dock in which the Maryland lies. The advantages of a sectional floating dry dock are well illustrated in this example. Divided into sections it can accommodate ships longer than its total length and can put each into commission as soon as repairs upon it are completed. This would be impossible in a solid structure in which vessels would naturally have to wait until repairs were completed upon all before any could be floated out.

WILL CHANGE TURRETS.

Acting Secretary of the Navy Newberry is to appoint a special board to devise means to prevent in future such explosions as that which recently took place on board the battleship Georgia. The idea is to improve the construction of the turrets and the plans will be worked out by the board. Regarding this board to adopt new ideas for protection to the men aboard battleships, the acting secretary said: "The facts as found by the board which investigated the accident will be used as a working basis. It is hoped that no more such accidents will be possible when the new plans are formulated. It will cost a great amount of money to reconstruct the turrets in our war vessels but everything possible will be done to make them safe."

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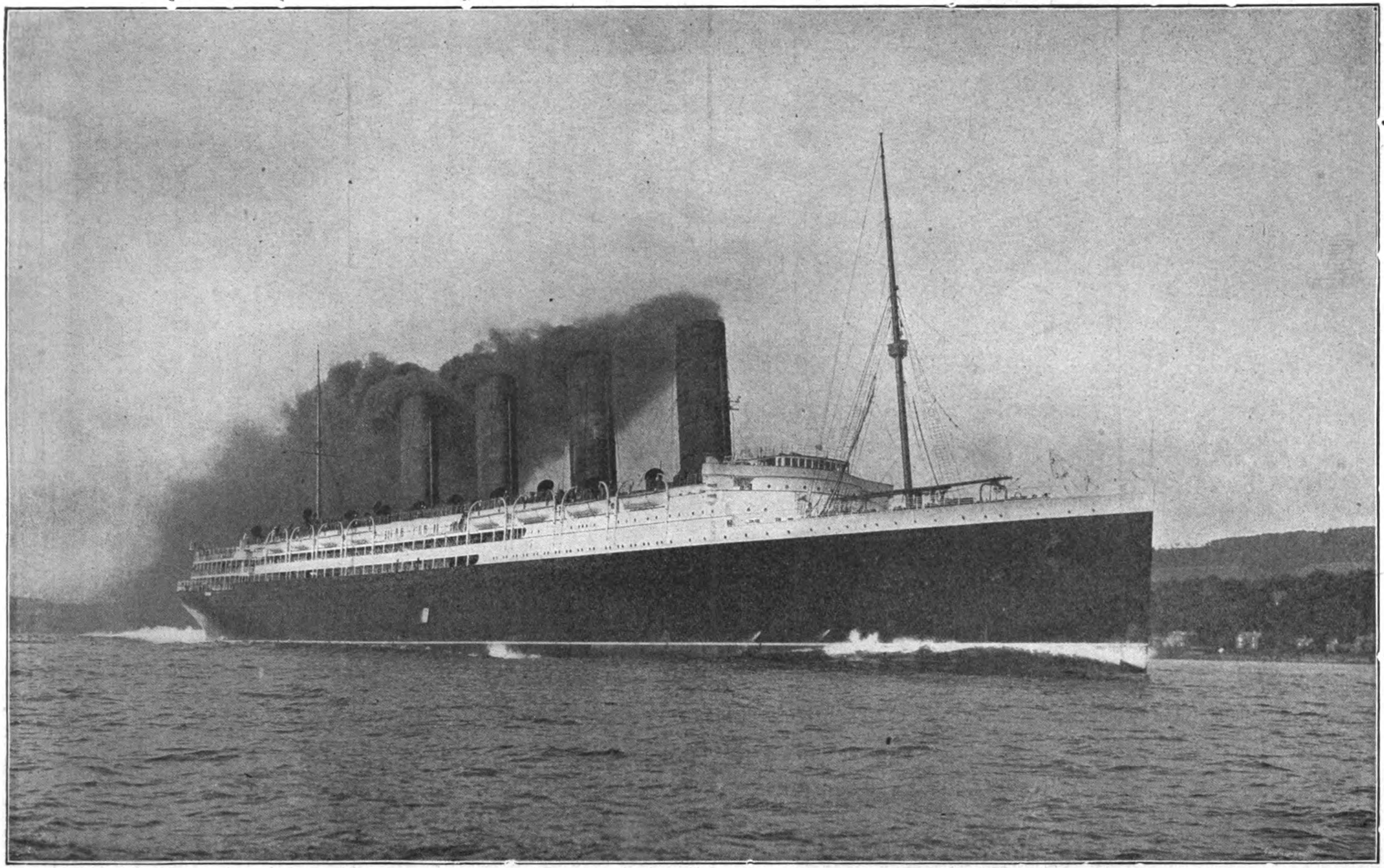
THE CUNARD TURBINE-DRIVEN QUADRUPLE-SCREW STEAMER LUSITANIA.



THIS PHOTOGRAPH, REPRODUCED FROM ENGINEERING, SHOWS THE GREAT EXPRESS LINER STEAMING AT OVER 25 KNOTS. THIS SHIP IS THE HIGHEST EXAMPLE OF NAVAL ARCHITECTURE AND MARINE ENGINEERING YET PRODUCED.

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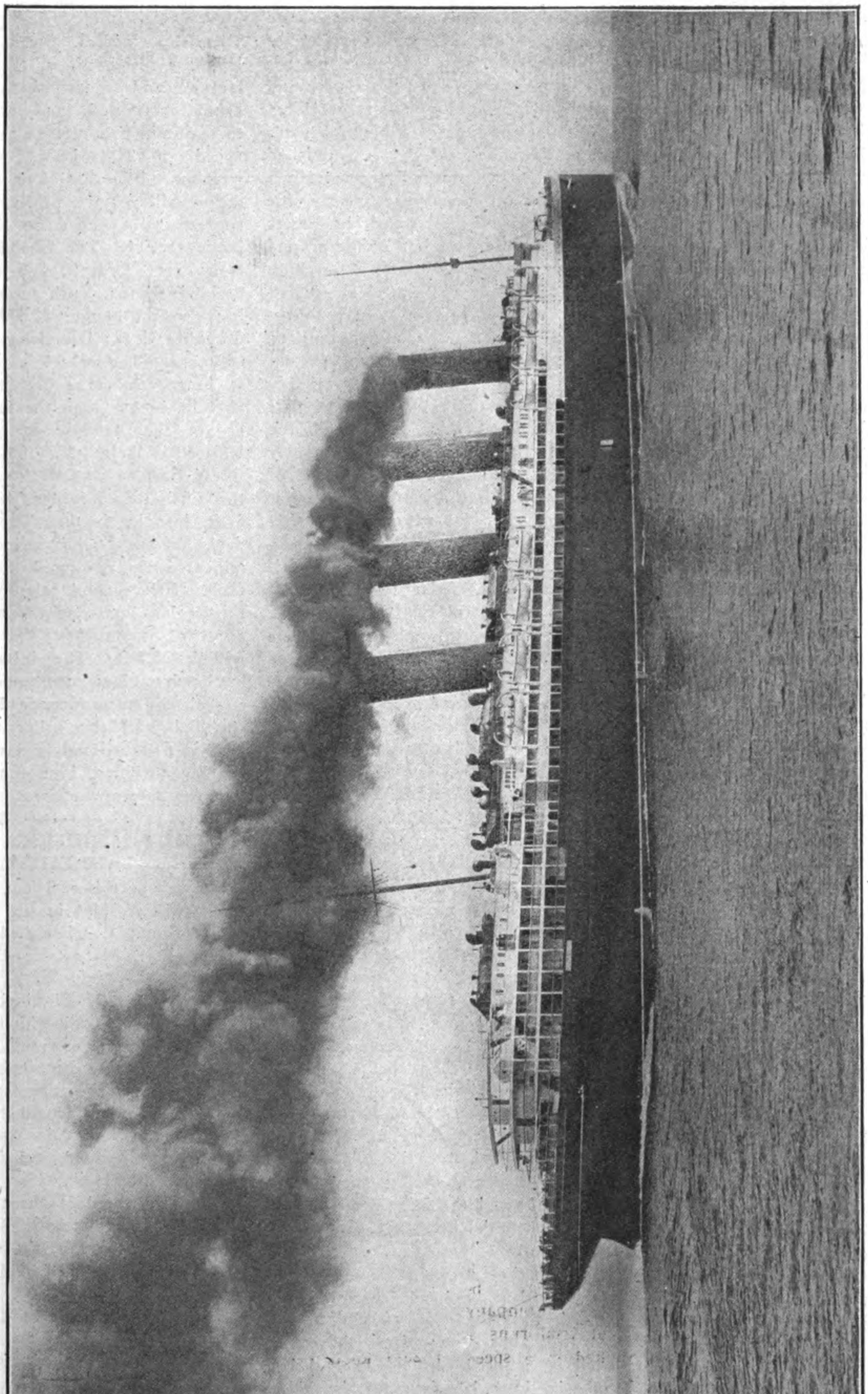

STERN VIEW OF THE LUSITANIA, REPRODUCED FROM ENGINEERING, STEAMING AT 25 KNOTS. NOTE THE WAVE LINE SHOWING THE HIGH EFFICIENCY OBTAINED IN RESPECT OF WAVE RESISTANCE.

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THE CUNARD LINER LUSITANIA.

(From *Engineering.*)

Within the next fortnight there is every prospect of a full realization of the hopes of practically every marine engineer in this country, when the Lusitania, the first of the two great Cunard liners, runs her official speed trials. As is universally known, the vessel represents the greatest step that has ever been taken either in size or power in a merchant ship, apart altogether from the adoption on a great scale of the turbine system of steam propulsion. The courage of the Cunard company in taking this step, and the professional skill which has enabled them to embark on an undertaking of such financial risk, merits the fullest measure of success; and because of this we are satisfied that all engineers will be pleased to know that the preliminary trials which have taken place on the Firth of Clyde promise satisfactory results when the official trials take place at the end of the month or early in August. The machinery has not yet been called upon to develop its full power, and, moreover, the skin of the ship is heavily coated with the chemically saturated mud of the River Clyde; but the data obtained on the measured-mile runs put beyond all doubt the question as to the attainment of the desired speeds on the measured mile and on the round voyage on the Atlantic respectively.

The Lusitania left the works of her builders on June 27, and difficulties beset the navigators in taking this vessel down a river so prescribed in its width as the Clyde. It is creditable to the Clyde Trust and other river authorities that they co-operated with the builders in their enterprise, and thus for many months powerful dredgers have been busy deepening the river to ensure a minimum depth of 23 ft. at low water of ordinary spring tides, and as the rise at Clydebank is not more than 11 ft., the total depth available at high water was not more than 34 ft. Fortunately, the wind was favorable to a good tide, and thus 34 ft. was, at some points, available. The vessel when she left Clydebank was drawing 29 ft. 9 in. aft, and only slightly less forward. The curves of the river, notably that at Dalmuir, are of small radii, and thus there was experienced great difficulty owing to the narrow channel; but with care the 15 miles of the river were successfully navigated at a speed of about 5 knots. It is particularly noticeable that the ship answered her helm with more than usual promptness when the two inner propellers were used in going down the river, and this same quality of quick steering was noticeable on the preliminary trials at practically all powers with four propellers working.

The photographs of the ship steaming at 25 knots, which are published herewith, are especially interesting, because they show very clearly the wave-line; and all naval architects will congratulate the builders and owners on having obtained a high efficiency in respect of wave-resistance. A close scrutiny of the illustrations will serve to convince anyone who is conversant with this feature of ships' resistance how remarkably low must be the resistance of this great vessel at this high speed, the wave formation being conspicuously small throughout the whole length of the vessel. Another interesting point which may here be mentioned is, that the ship proved as free from vibration at all powers as had been anticipated, so that, from this point of view, as well as others, the builders—Messrs. John Brown & Co.,—have maintained that uniform success which, for so many years, has characterized the work of their well-known Clydebank establishment.

THE CUNARD LEVIATHAN LUSITANIA ON HER TRIALS.

The express turbine steamer Lusitania, the first of the two great Cunard liners which have the joint distinction of being the largest vessels ever built, is just now undergoing her official and Admiralty trials, and our illustration shows this mammoth vessel being brought down the Clyde in charge of several tugs. We are privileged to reproduce this picture by the kind permission of *Engineer*, London. Owing to there being no dry dock on the Clyde large enough to accommodate her, the Lusitania has had to be taken round to Liverpool to be dry docked and cleaned preparatory to completing her high speed trials and the Admiralty run of 1,000 miles under seagoing conditions. These were commenced about July 24, and if they prove satisfactory, the ship will then be handed over to the Cunard company. It is understood that trial runs so far made have resulted in a speed of 25½ knots being attained. In a late issue of the MARINE REVIEW we shall be able to give some interesting views of the wonderful vessel and her magnificent accommodation which is unequalled by any ship afloat.

It is interesting to recall that the Lusitania was launched on June 7 of last year. She and her sister ship Mauretania, now fitting out on the Tyne by Messrs. Swan, Hunter & Wigham, Richardson, Ltd., are the largest and most powerful vessels ever constructed, and are estimated to maintain a minimum average ocean speed of 24½ knots in moderate weather. The fulfilment of this condition will restore to the British flag supremacy of speed on the trans-Atlantic service. The Lusitania's dimensions are: Length, 785 ft.; breadth, molded, 88 ft.; depth molded, 60 ft. 6 in.; gross tonnage, 32,500 tons; load draught, 33 ft.; launching weight, 16,000 tons. The vessel is therefore 160 ft. longer than the Campania, and 78 ft. 6 in. longer than the fastest steamer on the Atlantic at present, the Kaiser Wilhelm II. The renowned Great Eastern was 80 ft. shorter than the Lusitania, 5 ft. less in beam, and 3 ft. less in depth. There are nine decks on the Lusitania, including hold upper decks arranged for 550 first class, 500 second class, and 1,300 third class passengers, and with a crew of some 600. The personnel will be 3,150. The internal fittings in the first class accommodation is on a scale of magnificence hitherto unequalled, and the other accommodation is proportionately lavish. There are six turbines, four for ahead and two for astern work.

SCOUT CRUISER SALEM LAUNCHED.

The scout cruiser Salem, one of the three swiftest ships in the navy of the United States, was launched at the yard of the Fore River Ship Building Co., Quincy, Mass., July 27. The Salem is a sister ship of the Birmingham, recently launched at this yard, with the exception that the Salem is equipped with turbine engines while the Birmingham has engines of the reciprocating type. The Salem is 442 ft. in length between perpendiculars, 423 ft. 2 in. over all, 46 ft. 8 in. breadth molded, and draught, fully loaded, 19 ft. 1½ in. Her steaming radius at full speed is about 1,875 knots and at 10 knots about 6,250 knots. The third of these vessels, the Chester, was launched from the yard of the Bath Iron Works, Bath, Me., recently. Each of the cruisers is fitted with a different type of propelling machinery and the outcome of their trials is awaited with interest.

The Neptune line steamer Rhode Island was struck by the Enterprise line steamer Frank Jones in the harbor at Fall River, Mass., July 25, sustaining damages estimated to amount to between $15,000 to $20,000. The Jones suffered no damage.

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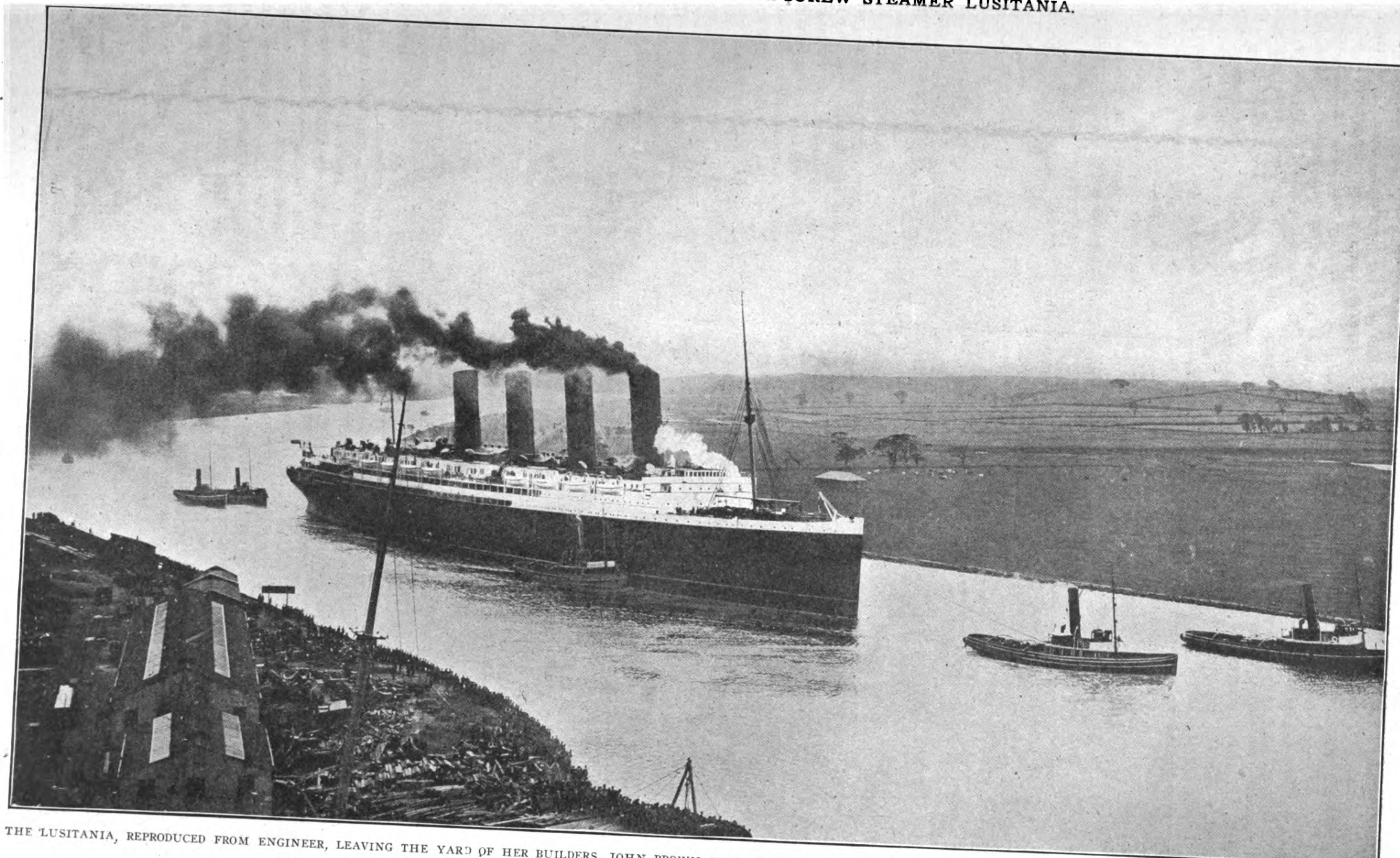

THE LUSITANIA, REPRODUCED FROM ENGINEER, LEAVING THE YARD OF HER BUILDERS, JOHN BROWN & CO., CLYDEBANK. THIS IS AN UNUSUALLY INTERESTING PHOTOGRAPH AS IT SHOWS THE RESTRICTED NATURE OF THE CLYDE, LONG FAMOUS AS THE CENTER OF THE WORLD'S SHIP BUILDING.

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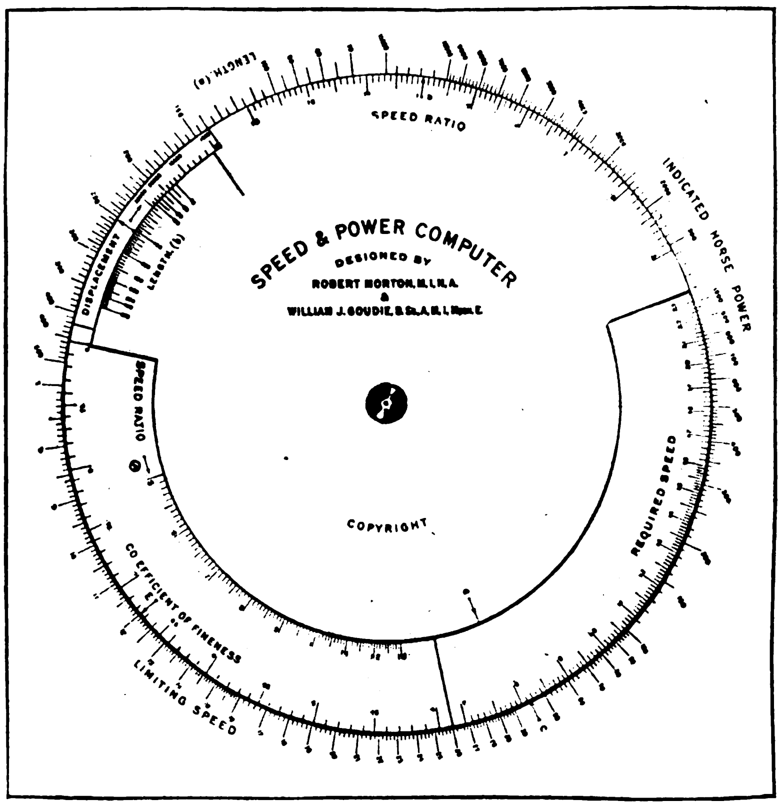
SPEED AND POWER COMPUTER.

A computer intended for making rapid approximations of the power and speed of steamships has just been brought out by Robert Morton and W. J. Goudie, 8 Prince's Square, Glasgow.

The instrument consists of two graduated circles in carboard arranged to move about a common center over a third fixed graduated circle. The latter, it will be seen from our illustration, has different graduations in three sectors, one being devoted to the length of a vessel, another to the horsepower required, and a third to the limiting speed, by which is denoted that speed at which the power required begins to increase very fast with a further increase in speed. The lower of the two movable discs is also divided into three sectors, graduated respectively for displacement, required speed, and coefficient of fineness. In one sector, moreover, there is an inner graduation, as shown in our illustration, for speed ratio. Finally, the first disc bears, as shown, graduations for length and speed ratio. Three problems commonly arising in a naval architect's office can be solved by suitably manipulating these discs These problems are: Firstly, the determination of the limiting speed of a vessel, having given her length and coefficient of fineness; secondly, the finding of the speed ratio, having given the required speed and the limiting speed; and, thirdly, with this limiting speed and speed ratio, and the length and displacement of the vessel, to determine the horsepower required to drive her at any desired speed. The results given by the calculator are stated to closely agree with actual practice in the case of twin-screw vessels; but for paddle and single-screw vessels the figure thus determined should be reduced by 5 to 10 per cent.



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ASHTON VALVE CO.

The Ashton Valve Co., who have been established in Boston, Mass., for the past thirty years, and whose factory is at the present time working both night and day to keep up with their requirements, are building a new factory in Cambridge, Mass., a suburb of Boston, which will give them four times their present manufacturing space. The main building of the new factory will be 200 ft. by 50 ft. with four stories, and separate boiler house and foundry.

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WIRELESS TELEGRAPHY ON THE LAKES

During the present summer a new agency has been established on the great lakes which is proving to be an invaluable auxiliary to navigation. This is the Clark Wireless Telegraph System, which is rendering a service that is the delight of vessel owners. Wireless telegraphy, of course, has been known on the Western Ocean for several years past, but not until the present summer has it been successfully introduced on the great lakes. During the past three or four years agents of various systems of wireless telegraphy have canvassed the great lakes district for business, but vessel interests did not appear to regard the service as at all imperative and promised such little support that the venture did not seem to be commercially practicable.

Two years ago Mr. Thomas E. Clark of Detroit induced the Detroit & Cleveland Steamship Co. to put his wireless apparatus aboard the City of Cleveland and the City of Detroit. During 1906 the system was extended to the Western States and Eastern States of the Detroit & Buffalo line, but this was the whole extent of wireless telegraphy on the great lakes up to the end of the season of 1906, though the company had been doing some commercial business otherwise. When navigation opened this season, however, Mr. Clark had established land stations at Cleveland and Detroit and solicited the business of the bulk freight owners. Detroit, as is well known, is the point at which vessel owners usually intercept their vessels with messages if the port of consignment of cargo has been changed since the vessel left the head of the lakes. There is, in fact, considerable business done in this line as vessels frequently leave the head of the lakes without the knowledge of their port of destination. This is usually communicated to them in passing Detroit. So efficient was the service rendered that the Clark Company handled 2,500 messages to vessels between Cleveland and Detroit during the month of June. A station was later established at Port Huron which, as a point of passage is invaluable to vessel owners, as it gives them ample time to formulate their dock orders to vessels before the vessels can reach Detroit. It usually takes a freighter about six hours to make the passage in the rivers from Port Huron to Detroit. Since the Port Huron station was established the Clark Wireless Telegraph Co. have done an increased business. Stations are now being established at Buffalo, Sault Ste. Marie and Duluth, and will be in operation by early fall.

MR. THOMAS E. CLARK, INVENTOR OF THE CLARK WIRELESS TELEGRAPH SYSTEM.

When this chain of wireless stations is completed vessel owners will be in greater command of their floating property than they have ever been for the reason that wireless communication is practically instantaneous. A wireless message travels at the rate of 186,000 miles a second or traverses the circumference of the earth seven times in one second. The fraction of time therefore necessary to communicate between Cleveland and Sault Ste. Marie is not measurable. The canal at Sault Ste. Marie is the most important point on the lakes because through it every pound of freight between Lake Superior and the lower lakes must pass. With the superb medium of intelligence afforded by wireless telegraphy it would be possible for a master to wire his owner in Cleveland when his steamer was entering the lock and to receive an answer several minutes before the steamer could get out of the lock—and vessels are frequently locked through the great locks at Sault Ste. Marie within ten minutes.

The Pittsburg Steamship Co. has during the past six or eight weeks been receiving messages direct into the Rockefeller building at Cleveland from Port Huron and Detroit with a precision and promptitude that is simply wonderful. It will only be a matter of time before many of the important carriers on the lakes are fitted with wireless instruments.

The layman, of course, has been familiar with wireless telegraphy as a natural phenomenon for several years past. He accepts it as a matter of fact and expresses small wonder at it simply because it is not forcibly presented to his understanding. If he will visit the laboratory of the Clark Wireless Telegraph System at Detroit and come into the actual and, as it were, visible presence of the phenomenon he cannot fail to be profoundly impressed. Among the paraphernalia in the laboratory is a little experimental station. On a table in one corner of the room stands a small wireless telegraph receiver with a small bamboo pole supporting three or four strands

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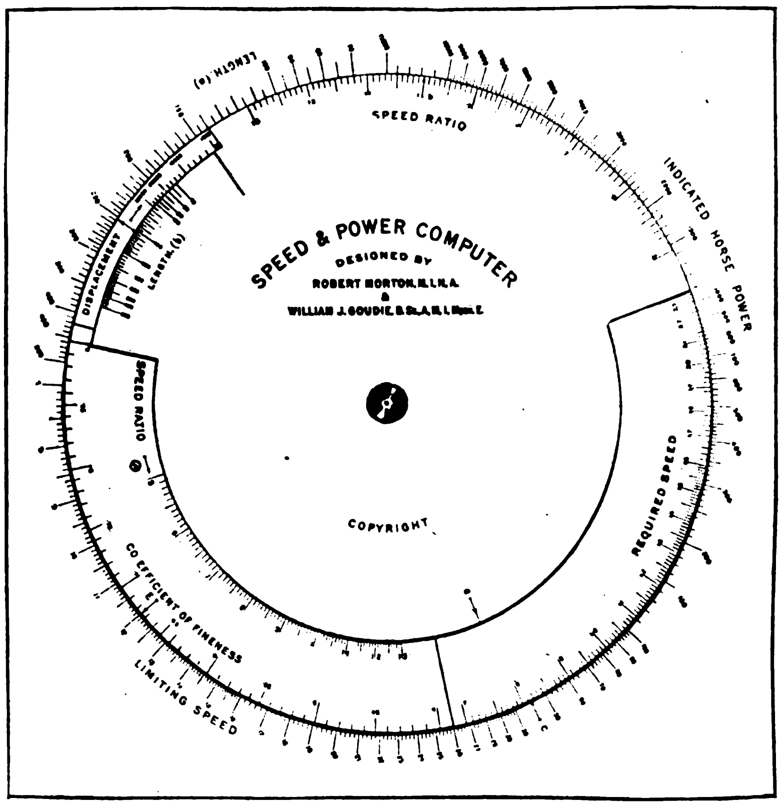

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During the present summer a new agency has been established on the great lakes which is proving to be an invaluable auxiliary to navigation. This is the Clark Wireless Telegraph System, which is rendering a service that is the delight of vessel owners. Wireless telegraphy, of course, has been known on the Western Ocean for several years past, but not until the present summer has it been successfully introduced on the great lakes. During the past three or four years agents of various systems of wireless telegraphy have canvassed the great lakes district for business, but vessel interests did not appear to regard the service as at all imperative and promised such little support that the venture did not seem to be commercially practicable.

MR. THOMAS E. CLARK, INVENTOR OF THE CLARK WIRELESS TELEGRAPH SYSTEM.

Two years ago Mr. Thomas E. Clark of Detroit induced the Detroit & Cleveland Steamship Co. to put his wireless apparatus aboard the City of Cleveland and the City of Detroit. During 1906 the system was extended to the Western States and Eastern States of the Detroit & Buffalo line, but this was the whole extent of wireless telegraphy on the great lakes up to the end of the season of 1906, though the company had been doing some commercial business otherwise. When navigation opened this season, however, Mr. Clark had established land stations at Cleveland and Detroit and solicited the business of the bulk freight owners. Detroit, as is well known, is the point at which vessel owners usually intercept their vessels with messages if the port of consignment of cargo has been changed since the vessel left the head of the lakes. There is, in fact, considerable business done in this line as vessels frequently leave the head of the lakes without the knowledge of their port of destination. This is usually communicated to them in passing Detroit. So efficient was the service rendered that the Clark Company handled 2,500 messages to vessels between Cleveland and Detroit during the month of June. A station was later established at Port Huron which, as a point of passage is invaluable to vessel owners, as it gives them ample time to formulate their dock orders to vessels before the vessels can reach Detroit. It usually takes a freighter about six hours to make the passage in the rivers from Port Huron to Detroit. Since the Port Huron station was established the Clark Wireless Telegraph Co. have done an increased business. Stations are now being established at Buffalo, Sault Ste. Marie and Duluth, and will be in operation by early fall.

When this chain of wireless stations is completed vessel owners will be in greater command of their floating property than they have ever been for the reason that wireless communication is practically instantaneous. A wireless message travels at the rate of 186,000 miles a second or traverses the circumference of the earth seven times in one second. The fraction of time therefore necessary to communicate between Cleveland and Sault Ste. Marie is not measurable. The canal at Sault Ste. Marie is the most important point on the lakes because through it every pound of freight between Lake Superior and the lower lakes must pass. With the superb medium of intelligence afforded by wireless telegraphy it would be possible for a master to wire his owner in Cleveland when his steamer was entering the lock and to receive an answer several minutes before the steamer could get out of the lock—and vessels are frequently locked through the great locks at Sault Ste. Marie within ten minutes.

The Pittsburg Steamship Co. has during the past six or eight weeks been receiving messages direct into the Rockefeller building at Cleveland from Port Huron and Detroit with a precision and promptitude that is simply wonderful. It will only be a matter of time before many of the important carriers on the lakes are fitted with wireless instruments.

The layman, of course, has been familiar with wireless telegraphy as a natural phenomenon for several years past. He accepts it as a matter of fact and expresses small wonder at it simply because it is not forcibly presented to his understanding. If he will visit the laboratory of the Clark Wireless Telegraph System at Detroit and come into the actual and, as it were, visible presence of the phenomenon he cannot fail to be profoundly impressed. Among the paraphernalia in the laboratory is a little experimental station. On a table in one corner of the room stands a small wireless telegraph receiver with a small bamboo pole supporting three or four strands

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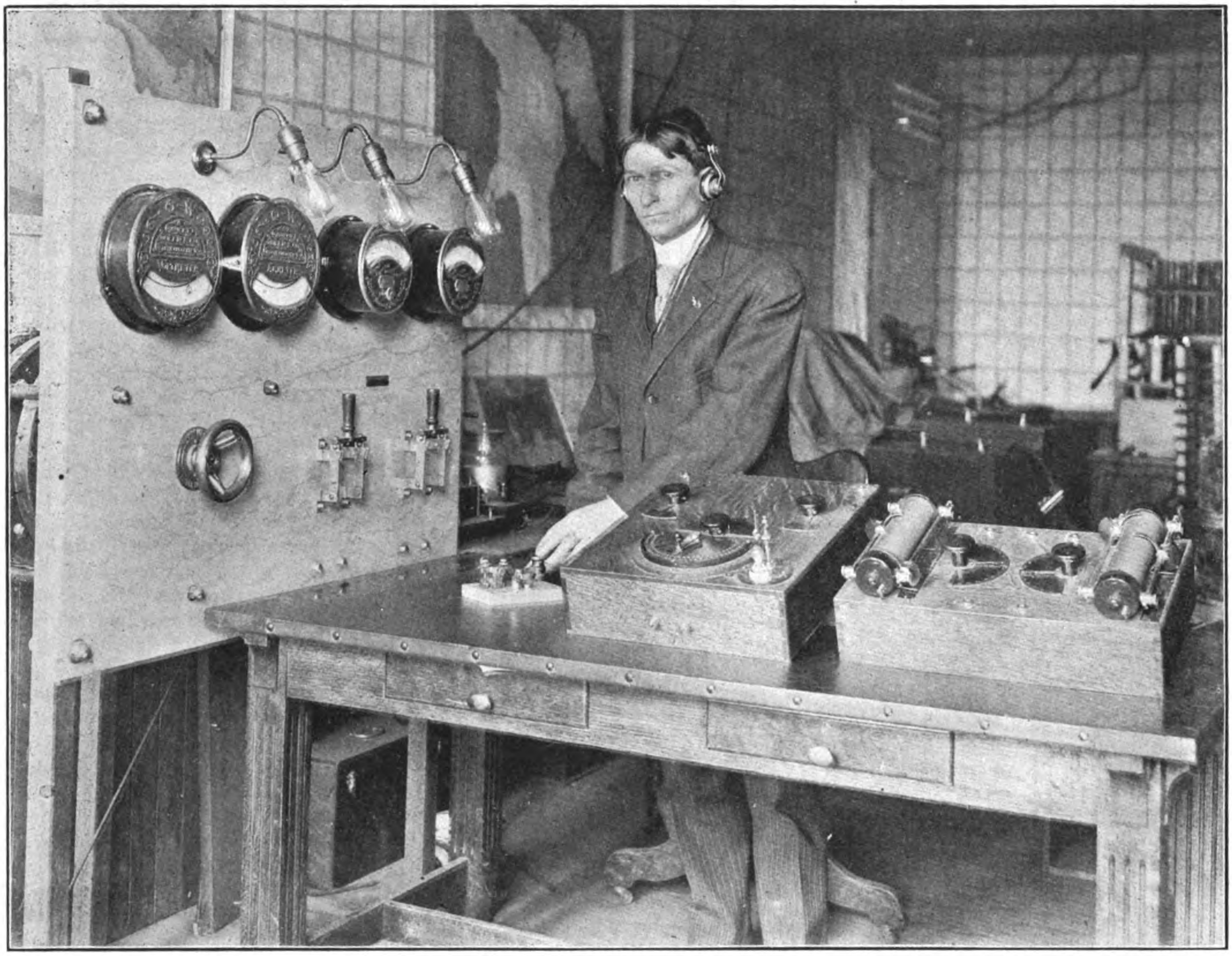

THE BUFFALO STATION OF THE CLARK WIRELESS TELEGRAPH SYSTEM, MR. THOMAS E. CLARK AT THE TRANSMITTER.

of antenna wire. The small bamboo pole with its wires leading down into the receiver represents the aerial mast and wires employed in wireless telegraph work in actual practice. This little receiver with its small bamboo pole was for purposes of illustration called the Cleveland station. The layman, if he visits the laboratory, will then be handed a small box, absolutely detached and unconnected with any instrument in the room, which he may carry in his hand much as he would a pound of candy from the confectioner's. This small box is a portable wireless transmitting instrument using four cells of dry battery with an oscillating coil in circuit, a spark gap and the regular Morse key. The layman wandering about the room with this small box under his arm represented the Detroit station. Whatever pressure is exhibited upon the key of this small box is repeated instantly by the telegraph receiver with the small bamboo pole at the end of the room. Of course this was merely a simple demonstration of the principle of wireless telegraphy confined within the space of one room, but nevertheless it seemed an astonishing and almost uncanny thing to set bells ringing at will without visible connection with them.

The laboratory was then darkened and the more powerful transmitting apparatus placed in operation. The visitor to the laboratory will witness some surprising developments of the force and power as used in wireless transmission, of its various phases and forms, the high frequency and high tension and oscillating discharges. A voltage of from 1,000,000 to 5,000,000 volts, jumping a 12-ft. gap like a bolt of lightning, were shown. This is very clearly illustrated in the accompanying photograph.

Wireless telegraphy is much more simple than is ordinarily supposed. The method of sending wireless messages is very much like the transmission of sound. In sound, the human voice or whatever makes the sound, sets up vibrations in the air, which are carried in a wave-like motion until they strike the ear. The voice, or whatever makes the sound, corresponds to the transmitting instrument in wireless telegraph, and the ear to the receiving instrument in wireless telegraph. The main difference between the two is that in the one the vibrations are set up in the air instead of in the ether.

Ether is believed to fill all space and to lie around the smallest atom or molecule in any substance. Accordingly sound in ether travels in wave-like motion, going through solid substances, and thus it is that wireless telegraph messages can be sent through brick walls, etc.

In wireless telegraph it is necessary to set up vibrations in ether of sufficient quantity and to provide a wireless receiver, sensitive enough to record the vibrations. When a violin string gives out a note it vibrates back and forth, causing the air to vibrate similarly. In transmitting a wireless message, an electric condensor is made to discharge, oscillating back and forth many thousand times per second across a small air gap. The vibrations in ether, thus produced, travel in all directions from the aerial wire attached to the sending instrument and supported by the vertical mast at the

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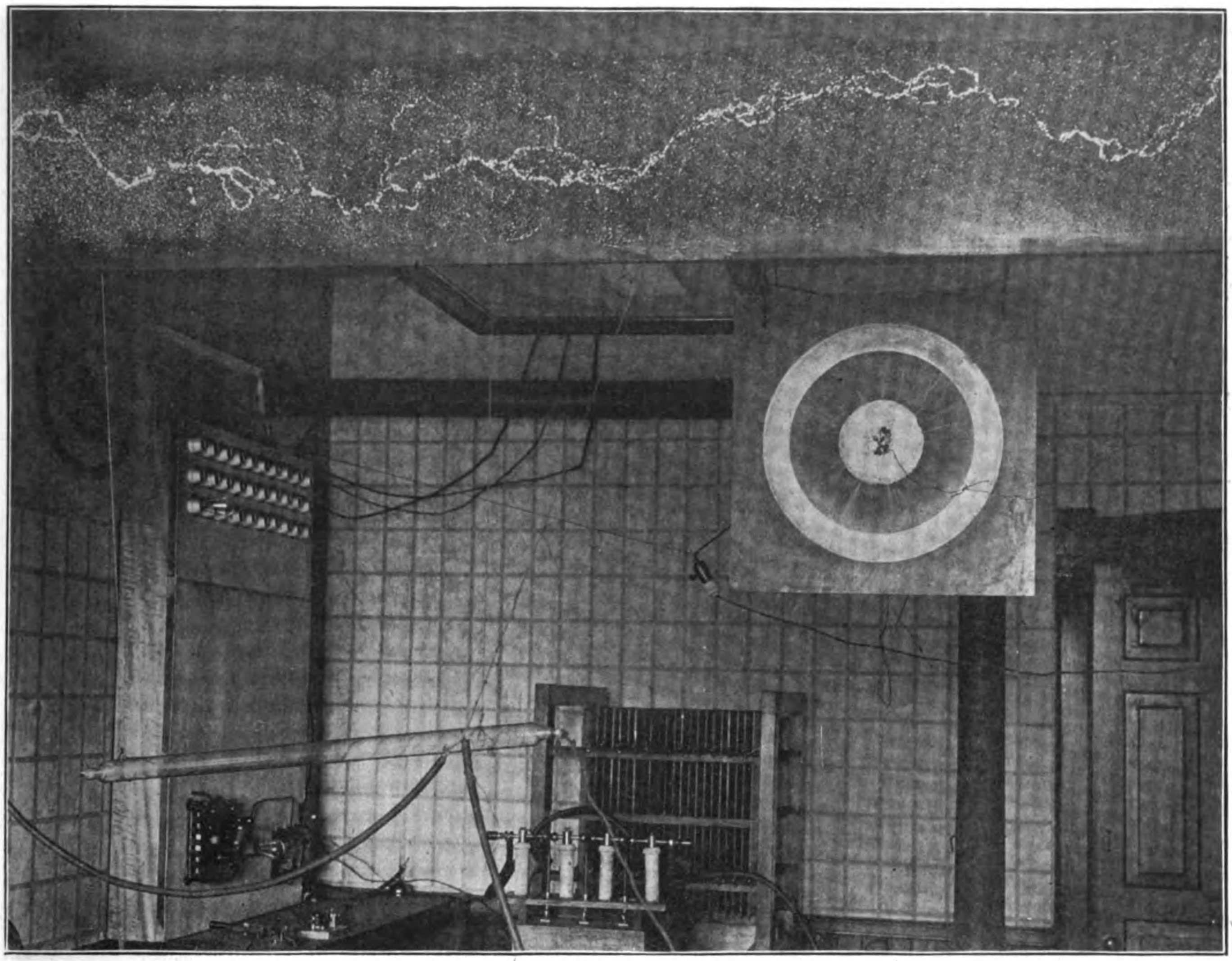

PHOTOGRAPH OF OVER 1,000,000 VOLTAGE JUMPING A 12-FT. GAP.

transmitting station and some of them will impinge upon the corresponding antenna wires, connecting the receiving instrument at the receiving station. The receiving wires, being good conductors, a number of these ether waves, called electric waves, will be collected and led down to the receiving instrument, somewhat similar to the human ear, which collects the air vibrations and carries them down to the ear drum.

When the electric wave impinges upon the vertical antennae wire and reaches the Clark wireless telegraph receiving instrument, known as a detector, the effect is to vary the sensitive electrical resistance in the local circuit, which contains the detector. This causes a disturbance or sound in the telephone receiver connected in the receiving circuit. The electric waves in the ether continue to come into the receiver, traveling at the rate of 186,000 miles per second, as long as the operator at the transmitting station holds his transmitting key down, and just so long a sound is heard by the receiving operator who takes down the message in dots and dashes of the Morse telegraph alphabet just as fast as they are sent by the transmitting operator, the receiver responding automatically in the Clark wireless telegraph system, always in readiness for the next dot or dash. Only with the sensitive Clark responder has it become possible to establish the record of long distance wireless telegraph communication between Detroit and Cleveland, Port Huron and Buffalo, when using a very small power at the transmitting end.

During the two past years the Clark wireless telegraph service has been carried on without interruption doing regular commercial telegraph work every day, the system working as well by night as by day and in bad weather, fogs or storms, as well as in fair weather, communication has always been maintained. The interposition of many buildings, cities or towns offers no obstruction.

SHOAL AT GROSSE POINT.

Steamer No. 1 of the United States Lake Survey has completed an examination of the area off Grosse Point, near Chicago, where the steamer James H. Reed stranded on May 3 last. A rocky shoal was discovered with 18.5 feet at present stage, lying 1¼ miles N. 65° E. true bearing (NE. by E. ¾ E.) from the Grosse Point light. While the water inside of this is a little deeper, the nature of the shoal is that of a submerged extension of the point reaching out into the lake. Mariners are warned not to get too far inshore off the regular sailing lines approaching Chicago, which are laid well out from this locality.

AMERICAN MAIL SERVICE TO AUSTRALIA.

Messrs. Andrew Weir & Co., shipowners, of London and Glasgow, are starting a new mail steamship service between San Francisco and Australasia to take the place of the American Oceanic line, which recently ceased operations in consequence of the failure of congress to pass the ship subsidy bill. The service was begun Aug. 1. The sailings will be monthly, and to enable mails to be dispatched twice a month the present route via Vancouver will also be employed. By the new route the boats will take only thirty days to Sydney.

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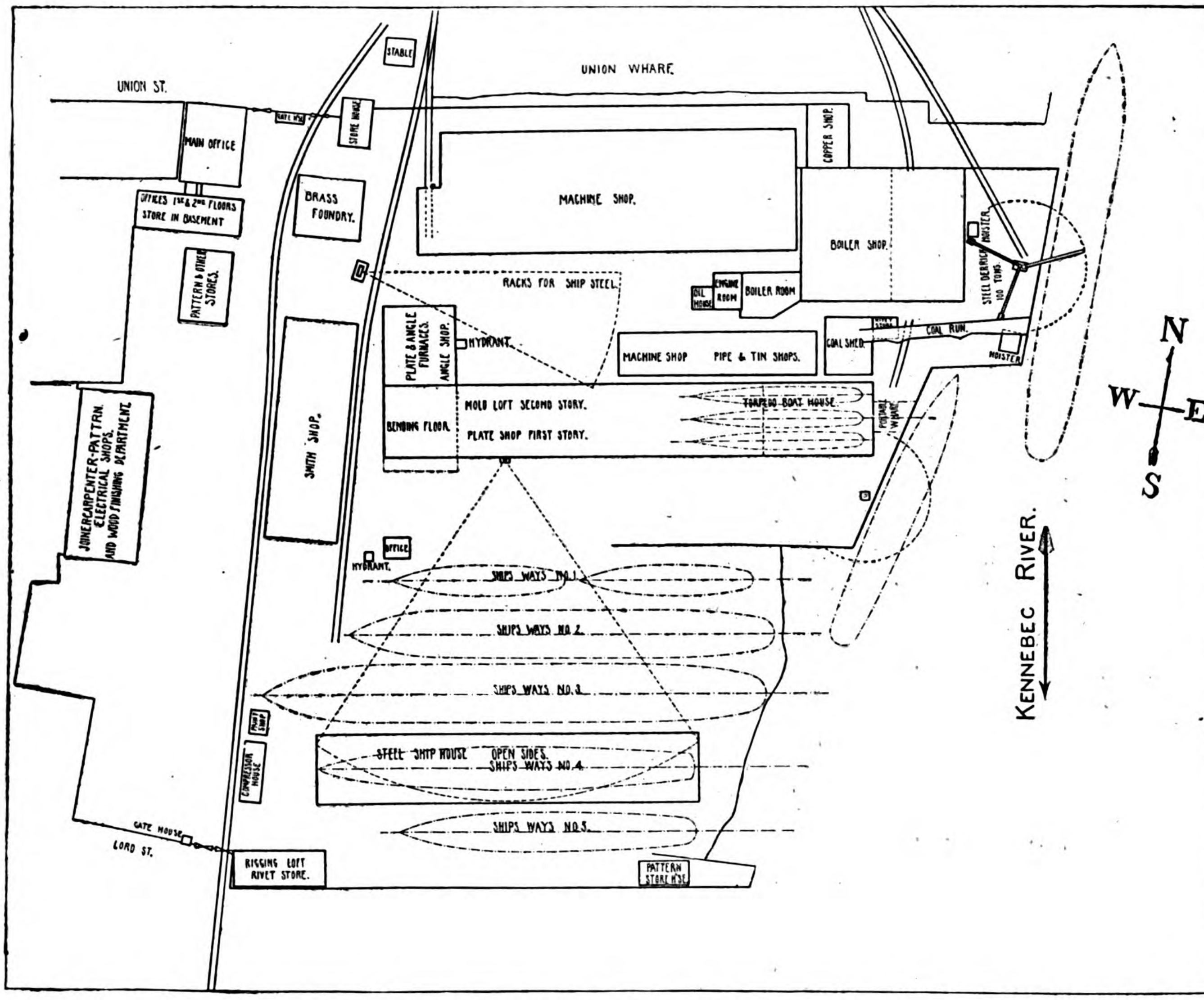
THE BATH IRON WORKS

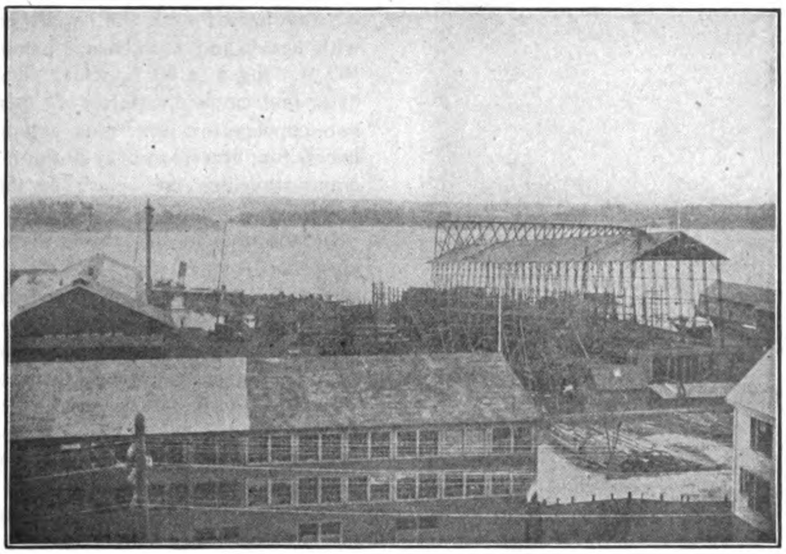


GENERAL PLAN OF THE PLANT OF THE BATH IRON WORKS, BATH, ME.

Situated on the west bank of the Kennebec river, (an ideal location for a shipbuilding yard), with a water frontage of 700 ft., shops and departments strongly built and equipped with all that is newest and best for ship and machinery construction, covering an area of eleven acres, and with the entire plant lighted and principally operated by electricity, the Bath Iron Works—though extremely young in years—can today be classed among the premier yards of the country. Constantly having additions and alterations made to the plant to cope with their increasing business, little remains of the original buildings of ten years ago, the various departments, thirty-seven in number, having been arranged to meet with the requirements of the modern shipbuilding yard.

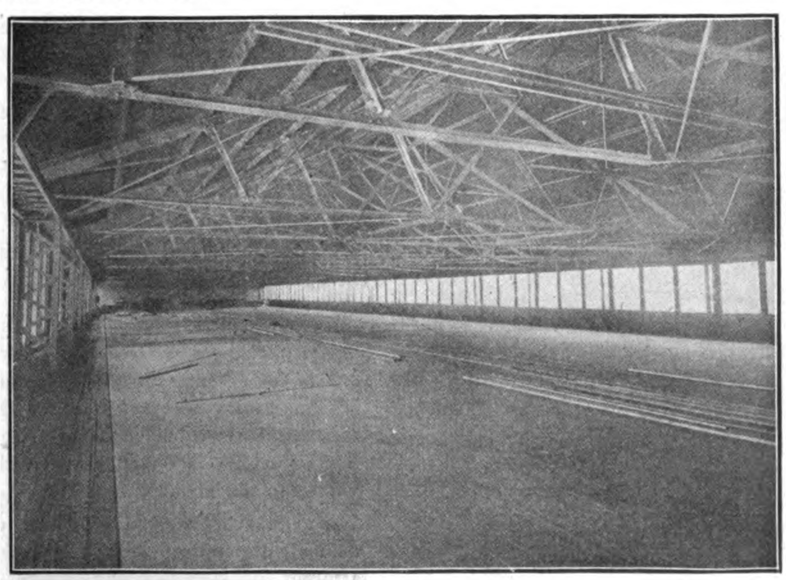
A study of the accompanying plan of the works shows the general arrangement and layout of the ship building

GENERAL VIEW OF INTERIOR OF ENGINE MACHINE SHOP.



VIEW OF SOUTHERN PORTION OF PLANT.

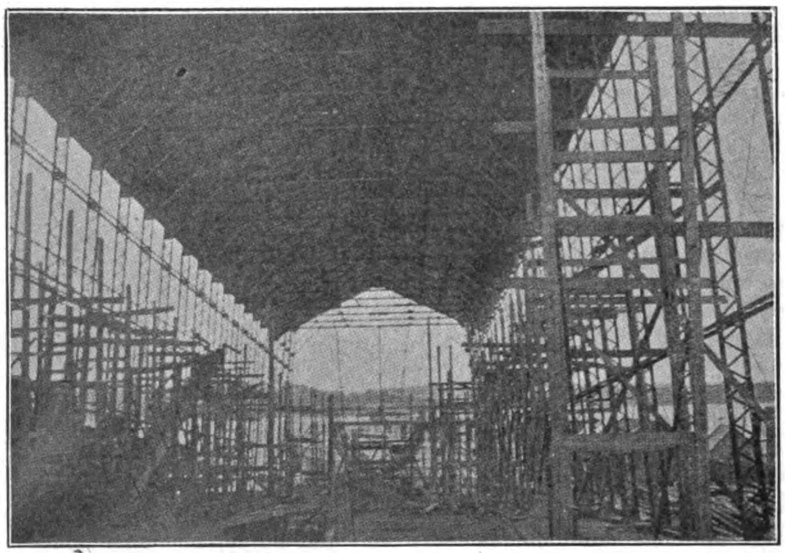
ways, which are so located as to handle with ease the building of the largest type of freighter or passenger steamer. A steel housing or shed covers one of the ways, which are five in number, this arrangement being provision for yacht construction, or other fine work, during winter when weather is seldom favorable, the house completely protecting the vessel. A large steel building adjacent to the plate shop is reserved for the construction of torpedo boats and other light-built high-speed craft, the building being large enough to accommodate at one time three craft of the torpedo-boat type. Arrangements are also made for the machinery installation and launching from the ways. The plate shop, which is 340 ft. long and 60 ft. wide, is constructed of steel and contains all the necessary machinery for shaping, drilling, etc., all the tools being operated by electricity. Attached to the plate shop is the bending shed, angle-smith shop, and plate and angle furnaces.



GENERAL INTERIOR OF MOLD LOFT.

The machine shop for engine work is 320 ft. in length and 100 ft. in width, and is admirable in every respect containing as it does the latest and most varied types of lathes, planes, boring machinery, and shapers. As in most of the departments, the machinery is electric-driven, two 50-horsepower motors being installed. Among the other noticeable features in this department are a planer with a scope of 10 ft. by 10 ft. by 26 ft., a boring mill capable of swinging a 16-ft. circle, and a radial drill with a 60-in. arm and a height of 10 ft. Three electric traveling cranes—one 20-ton and two 5-ton—are also a part of the shop equipment. The shipyard machine shop, in another section of the plant, contains all the machinery necessary in the manufacture of ship fitting and marine hardware.

The boiler shop, equipped with a hydraulic plant working at a pressure of 1,500 lbs. per sq. in., is 140 ft. long and



SHIP SHED.

110 ft. wide. Among the other powerful hydraulic tools in this department may be mentioned a 100-ton riveter, a flanger with three 40-ton rams, a punch capable of punching a 6-in. hole through the heaviest boiler steel, and a special tube bender for water-tube boiler construction. There are also the usual punches, shears, drills, etc.

In the shipyard the material is handled by a very complete system of trolleys and cableways. There is also a complete equipment of pneumatic power throughout the yard, the power-house containing a 100-horsepower electric motor driving a large duplex air compressor at a pressure of 80 lbs. per sq. in. The electrical department is very complete, the Bath Iron Works installing the electric plant on vessels built at the works. Here it may be mentioned that there is in operation a telephone system throughout the plant.

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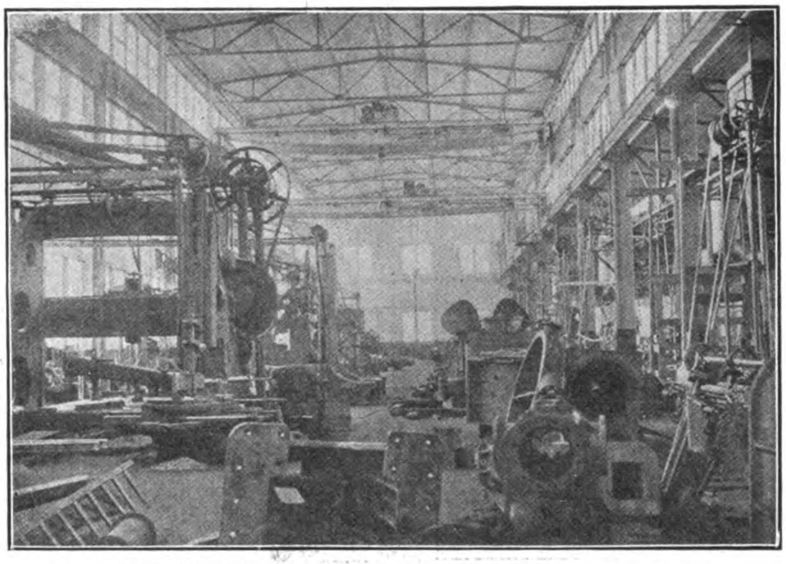
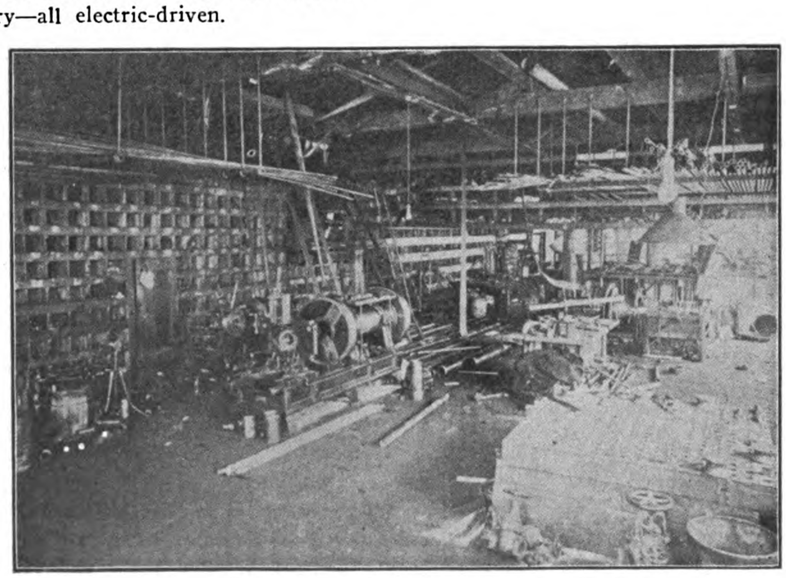


ANOTHER VIEW OF INTERIOR OF ENGINE MACHINE SHOP.

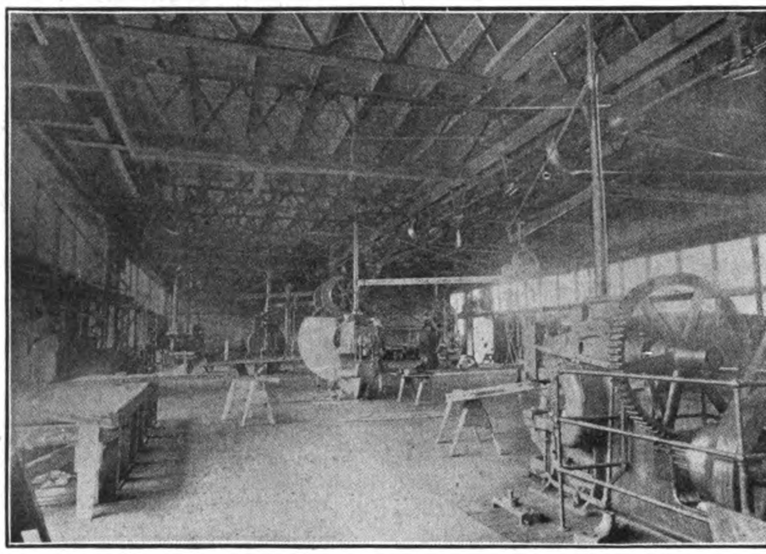
The mold loft, 60 ft. wide and 340 ft. long, is especially worthy of notice being long enough to admit the laying down of the sheer and half-breadth plans full size, without a break, of 95 per cent of the vessels built in the United States, and its proportions are such that any vessel built or projected could be laid down upon its floor. A small shop in the corner of the loft is used by the hull pattern maker, this arrangement greatly facilitating his work in consulting the lines on the loft floor. There are two pattern shops and pattern storehouses, and a joiner shop 140 ft. long and 60 ft. wide. This shop is fitted with about 25 benches and has a large storehouse for ordinary and selected woods. Adjoining the shop is a polishing shop where the fine woodwork is finished. The paint shop is in an isolated part of the yard, all paints, spirit and oils being kept there. The carpenter shop is large and well arranged, and contains log rotary saws, four sided planers, and other machinery—all electric-driven.



PIPE SHOP.

The blacksmith shop, provided with 20 stationary forges and well equipped with heavy and light steam hammers, is 180 ft. long and 60 ft. wide. The foundries find employment for 125 men, have two cupolas for iron, pots and air furnaces for brass, and a 20-ton electric crane traveling the length of the main building.

In addition to the above there are a pipe shop, copper shop, and tin shop, all splendidly equipped, and numerous stores and smaller buildings. A 100-ton derrick, constructed at the works and especially designed to suit their requirements, is in operation on one of the wharfs, power being derived from two steam hoisters. The offices are in a spacious building at the entrance to the yards, the upper floor of the main building being devoted to the hull draughting department. The engine and machinery draughting departments are on the upper floor of an adjoining building, the lower floor of which is occupied by government



INTERIOR OF SHIP YARD PLATE SHOP.

officials and inspectors.

The company has had a statute and a nautical mile deep water course surveyed, the course having been measured and approved by the United States government, and several official steaming trials of war vessels have taken place here.

The officers of the Bath Iron Works are John S. Hyde, president and general manager; Edward W. Hyde, vice president; and H. H. McCarthy, treasurer.

ON AN ATLANTIC LINER.

Mrs. A.: "Just imagine, Hiram. One of the sailors has just told me that this steamer is now in communication with her sister ship! I wonder what the conversation is about?"

Mr. A.: "H'm. Most likely each is asking the other if her cargo is on straight."

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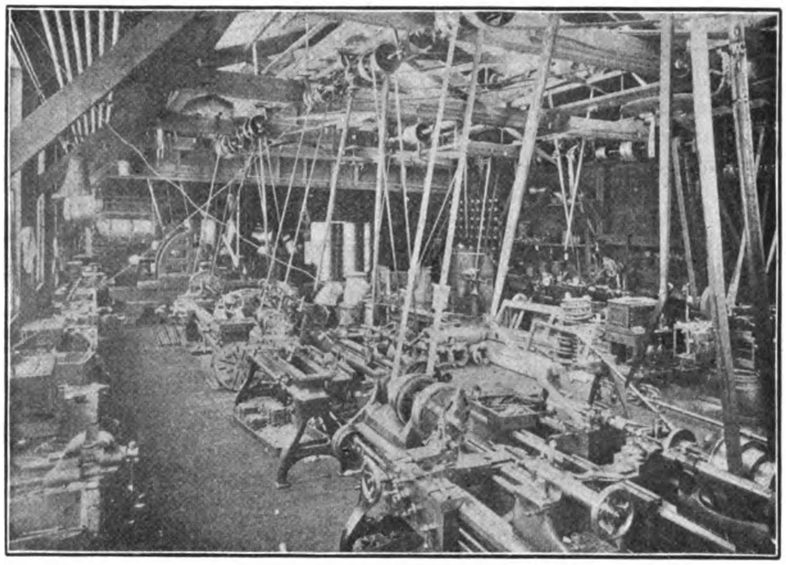
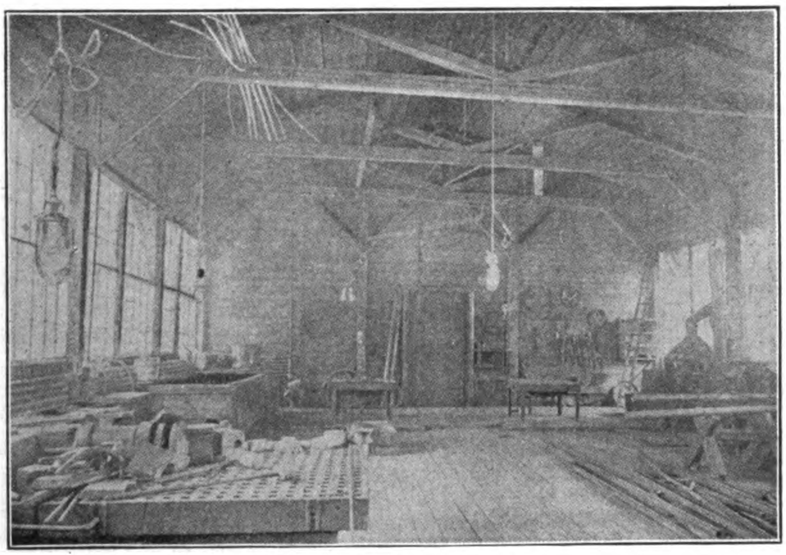
TURBINE BOATS IN HEAVY SEAS.

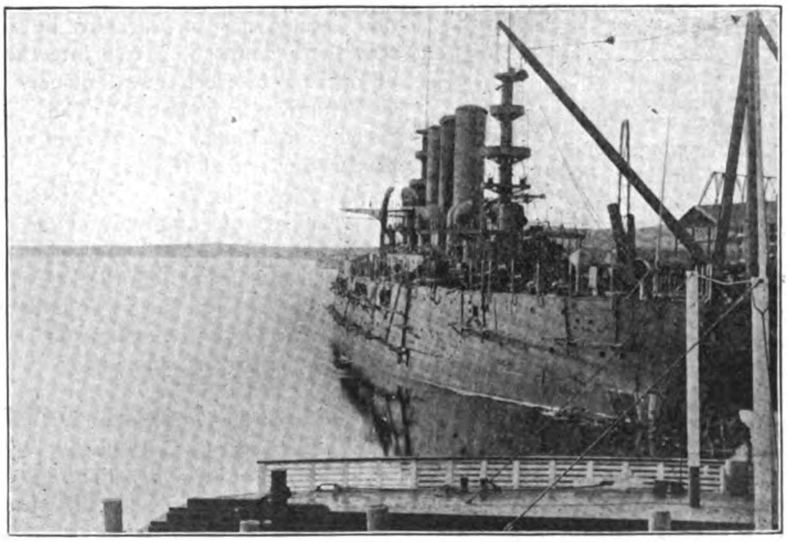
Discussing this question *Engineering*. says that last winter the twin-screw Channel steamer Sussex was, owing to stress of weather unable to leave Dieppe till about twelve hours after her proper time. Two and a half hours after she had started, the Brighton, which is a turbine steamer, also left Dieppe, and her passengers caught the same train to London as those of the Sussex. It appears, in fact, that no matter what the severity of the weather, the turbines do not require to be eased, and are not eased save on direct orders from the bridge, dictated by the necessities of the ship and not those of the engine-room. On the other hand, as is well known, it is necessary to slow down and and stand by, reciprocating engines in really bad weather, or they might be wrecked by the racing of the propeller. Possibly an explanation of the contradictory reports which are prevalent in this regard may be found in the turbine being superior in really heavy weather, but losing speed as compared with its rival in more moderate seas. Another factor in the question which may be at least partially responsible for the prevalent opinion is that in service the turbine boats never show the same superiority over sister vessels in the matter of fuel economy as they have done on trial. The principal reason for this would appear to lie in the circumstances that at full speed reciprocating engines are being over-driven; whilst in the case of every turbine ship of which data have been published it is obvious that, even at full speed, the turbine is still far from exerting its maximum power, and could easily dispose of more steam if it were forthcoming from the boilers. Further, as marine turbines are always under-speeded, the faster the ship travels the more economical does the turbine become; so that on trial it is working at its best efficiency, whilst the reverse is the case with the reciprocating engine. The extent to which ships have "over-turbined" has been very remarkable. In the case of the Dreadnought the official figures show that her turbines could easily develop 20 to 25 per cent, more power than that obtained in the nominal full-power trial, and still have the inlet pressure not higher than it would be in the steam-chest of a reciprocating engine working with the same boiler-pressure. In the navy, since the introduction of water-tube boilers, it has been usual to generate steam at, say, 250 lb. pressure, and reduce this to 200 lb. at the engines, a reserve



INTERIOR OF SHIP YARD MACHINE SHOP, BATH IRON WORKS.



COPPER SHOP, BATH IRON WORKS.



BATTLESHIP GEORGIA, BUILT BY THE BATH IRON WORKS.

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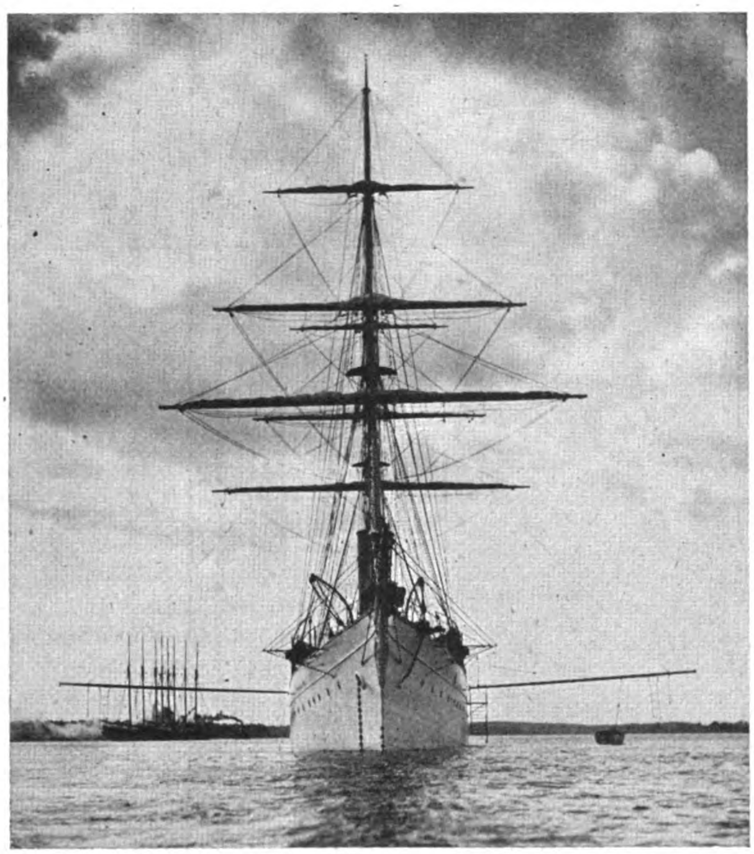
thus being provided, which greatly facilitates station-keeping. In the Dreadnought, however, the reduction was nearer 100 lb. than 50 lb., and, as Mr. Griffith stated at the Conference, the torque on the shafting is nearly proportional to the inlet pressure of the turbines. That the practice of "over-turbining" is not confined to the navy would seem to be borne out by the statement recently published, that at the late overhaul of the Carmania an attempt was made to reduce the steam-way through the turbine by twisting the blades to a more accurate angle.



STEAM YACHT ELEANOR—BUILT BY THE BATH IRON WORKS.

The Dubuque Boat & Boiler Works, Dubuque, Iowa, are building the hulls together with pontoons and pipe lines of two hydraulic dredges for the government engineer's department, at an estimated cost of $238,000 for the two. One dredge is to be delivered at St. Louis next September and the other next April. Contract was entered into with the E. H. Abadie Co., St. Louis, for four main pump engines of 500-H. P. each and two centrifugal dredging pumps, 32 in. diameter of discharge for the two dredges, at a total cost of $34,595. The Schoellhorn-Albrecht Machine Co. of St. Louis were given the contract for four hauling winches for the two dredges at a cost of $6,400.

A GAS-DRIVEN BATTLESHIP.

Perhaps the most important of the papers read at the meeting in London of the Institution of Naval Architects was on "The Influence of Machinery on the Gun Power of the Modern Warship," by James McKechnie. Mr. McKechnie is the engineering director of Messrs. Vickers, Sons & Maxim's works at Barrow-in-Furness, and is widely known in the world of ship building. The idea of his paper was, he said, to analyse the design of all machinery so far as it affected the fighting efficiency of the latest types of warships in order that there might be a free interchange of opinion between naval officers and constructive engineers. The influence of machinery on the gun power of the modern ship was:

(1) Direct so far as it relates to the supply of ammunition to the gun, and to the training, elevating, loading, and firing of the gun; and

(2) Indirect, so far as it influences the position of the guns on board ship—a matter of increasing importance.

The latter part of the subject might take precedence as it raised important general questions which, although not perhaps germane to the title of the paper, could not be altogether neglected. But it might be well to say at the outset that it was not proposed to deal with the speed of ships. The engineer was not called upon to settle the question of the tactical advantage of 21 knots as against 18 knots or 19 knots, although it must be admitted that the increase in engine power necessary to give the higher speed involved more room in the ship, and thus might tend to affect the position of the guns. We were told, however, that the practice was to primarily regard the ship as a floating battery, and that, in evolving the design, the offensive power was the first and paramount consideration. This might affect the length of the ship, apart altogether from speed considerations, in order to secure the most effective disposition of the guns in the longitudinal line. Accepting this view for the sake of argument, presuming that it involved a more or less arbitrary decision as to the length of the ship, speed, protection, and endurance become secondary, but were still more or less competitive qualities. In such a vessel as the Dreadnought the direct reduction in weight of propelling machinery for a decrease in speed from 21 knots to 18½ knots would be about 700 tons. This difference in weight might have permitted two more 12-in. guns with their ammunition to be carried, if placed within the citadel for barbette protection. But, as had been said, the point under consideration was not so much the tactical advantage of higher speed as the question of the space occupied by propelling machinery. This question was the more urgent in view of the decision to adopt only the largest calibre of gun for the primary armament in our ships. As this limited the number of guns for the weight allowed for ordnance, it became more necessary to make fuller use of the weapons by giving each the greatest possible arc of training, and to ensure the highest percentage of hits within a given time. In other words, if only large calibre guns were to be used, involving considerable weight for the machinery manipulating them, every gun must be so placed as to enable it to fire on either broadside, and at the same time to give the maximum of bow and stern fire. To the ordnance officer the space required for the propelling machinery created difficulties because the position of the boilers, as well as of the engines, could be modified only to a very limited extent. Moreover, the presence of uptakes and funnels seriously interfered with the gun arrangement. This objection was not

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serious so long as the armament included large guns at the bow and stern only with secondary weapons along each side, supplied with ammunition from suitable passages to the magazines forward and aft. But, with all the guns of large calibre, involving training and elevating machinery as well as ammunition hoists requiring a large area of considerable depth, the limitations on the effective placing of the guns on board had been intensified. Apart from the obstruction offered to wide angles of fire presented by uptakes and funnels. Engineers must, therefore, recognize the necessity for some modification to meet the new conditions. It might be urged that such a recognition was premature, but even if the development in ordnance now projected was not permanent, the tendency must be towards the adoption of more guns of large power. It was significant, too, that with only one or two exceptions, all the first-class Powers had followed the British example of adopting exclusively large guns in a primary battery, and the arguments by Lieut.-Commander Sims, in his report on the all big one-calibre gun ship, afforded justification for favoring all 12-in. guns, instead of a combination of 12-in. and 10-in. or 9.2-in. guns. The weight of a pair of 10-in. guns, with their barbette mountings, was but slightly more than half that of a pair of 12-in. guns with their mountings, but the armor protection and space involved did not show such proportional difference, and the cost alike in men and power was not strikingly in favor of the 10-in. gun. The striking energy of the 12-in. gun, however, was enormously greater, so that the balance of advantage seemed to favor the all 12-in. gun battleship. This, however, was only incidental to the main consideration of the duty of the engineer—to evolve arrangements that would meet the demands of others, as his claim alike on the displacement and on the available space in a warship was subservient to the dominant requirements of the ordnance officer. This raised the important question as to whether the adoption of internal combustion machinery would not effect such advantage from the point of view of fighting efficiency as to induce naval authorities to encourage the application of this prime mover. Interesting papers had already been read before the institution on the possibility of applying oil or gas engines for the propulsion of torpedo-boat destroyers. They dealt with the problems connected with the engine only, and not with the effect on gun power. In this paper, however, it was proposed to deal more with the influence of the adoption of such internal combustion engines on the gun arrangement of ships. Plans were given showing the application of gas engines to a battleship, and of oil engines to a torpedo-boat destroyer, and with these were corresponding drawings for similar types of ships of exactly the same size, but fitted with steam machinery. The success which had attended the application of the Parsons steam turbine, not only in battleships and cruisers, but especially in torpedo craft, suggested that the fullest advantage would be realized by the development of the same system using gas, or preferably oil, so that steam boilers might be entirely dispensed with, and it would be peculiarly appropriate if this further advance should be initiated by the Hon. C. A. Parsons, C. B. who deserved so much credit for the success of the steam turbine. Before referring to the designs of the ships with steam and internal combustion engines, brief general reference might be made to the latter type of prime mover. At the Vickers works at Barrow-in-Furness there had been constructed internal combustion marine engines of a power equivalent to about 40,000 i. h. p., and for three or four years almost continuous research work had been undertaken. The experiments had led to the adoption of a two-stroke cycle gas engine possessing satisfactory features. This engine might be worked either by producer gas, heavy oil, or compressed air. It might be made reversible as easily as the steam or compressed air engine. It was possible to use in conjunction with it pressure gas generators, which delivered their gas direct to the engines, as there was no necessity to pass it through a scrubber or any other cleansing apparatus. There was thereby ensured the maximum of heat in the engine itself, since none of it was wasted in the process of cleansing. The cycle upon which the engine worked rendered it possible also to recover the heat of the exhaust gas and to utilize it in the engine. A gas pump was unnecessary, so that one of the chief objections to the two-stroke cycle engine was thereby eliminated. The compressed air plant might be located in any part of the ship. From it one main led direct to the propelling engines, and another to the pressure-gas producers. The steam required for keeping down the temperature in the producer and for preventing the formation of clinker was generated in association with the compressed air. The possibility of poisonous gases exuding from the mains had been carefully considered, and the supply pipes, as well as the producers were jacketed with compressed air with which the gas escaping from the inner passed to the producer or the engine. An important feature was that the engine might be worked either by gas or heavy oil, so that coal might be stored in the bunkers and oil in the double bottom. This gave a duplication which was always desirable. The change from gas to oil might be made almost instantaneously. With oil the engine might be started when cold within a few minutes; this would be an important tactical advantage in warships. The compressor and producer plants were governed automatically according to the consumption of the propelling engines. Illustrations were given by Mr. McKechnie of a 30-knot torpedo-boat destroyer with steam machinery, and a vessel of identical dimensions and speed driven by engines using oil having a flash point of about 200 deg. F. An auxiliary oil engine would drive an electric generator to provide current for motors to operate steering and anchor gear, the bilge pumps, and other machinery on board. The steam-driven destroyer illustrated was one of many in the British service, and, in showing the adaptation of the internal combustion engine to a corresponding boat, it had been considered preferable to indicate the effect on gun fire rather than to utilize the economy in weight and space in reducing the size of the vessel or in increasing the speed. Instead of having only one 12-pounder and five 6-pounder guns, the oil-driven vessel was fitted with four quick-firing guns of 4-in. calibre, two 6-pounder quick-firing guns. Both vessels had two torpedo tubes. The quantity of ammunition—the number of rounds per gun—had not been reduced, although the guns carried were of greater calibre. A sufficient quantity of fuel had been allowed to give the oil-driven vessel, at the full speed of 30 knots, a radius of action six and a half times greater than that of the steam-driven destroyer with full coal supply. The absence of funnels and their fittings enabled the guns to have a much wider arc of training. There was usually much smoke and sometimes flames from the funnels of steam-driven destroyers, especially when running at full speed, and the absence of these in oil-driven craft

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would render them less liable to detection in war. Experience with six-cylinder oil engines at the Vickers works showed that there would be less noise than with the reciprocating steam engine. The difference in weight due to the adoption of the oil engine might, of course, be utilized to reduce dimensions and displacement, the armament being the same Another illustration shown was of a battleship constructed at the Vickers works at Barrow-in-Furness, and with it was provided a design of a corresponding vessel fitted with the producer gas engines already described. The advantages alike in weight, space and arangement, resulting from the use of the gas machinery had been utilized to improve the gun power. The gas machinery was divided into three groups accommodated in six compartments. The ship had four propeller shafts, each driven by a ten-cylinder vertical gas engine. Two of the sets of engines were placed, each in the fore and aft line, in each of the aft compartments. The engines were purely for propelling the ship. The gas producers of the pressure type occupied the two center compartments. In the forward compartments there were four sets of air compressors driven by gas engines. Heavy oil engines would be used for driving the electric generators for lighting the ship and for supplying current to motors for working the steering and anchor gear, the ship's pumping machinery, etc. But this electric generating plant could be fitted in any position in the ship found most convenient.

As of some interest, although not vital to the consideration of the influence of this machinery on the gun power of warships, the approximate weights of steam, gas, and oil machinery of a 16,000 H. P. battleship were given in tabular form. These figures would, of course, be subject to alteration when the details of design were made to meet specified conditions. We reproduce the table:

	Steam Engine.	Gas Engine.	Oil Engine.
Indicated horsepower available for propelling the ship..	16,000	16,000	16,000
Weight of machinery, including usual auxiliaries, but not deck machinery	1,585 tons*	1,105 tons†	750 tons‡
Indicated horsepower per ton of machinery...........	10.1	14.48	21.33
Area occupied by machinery engines and boilers or producers	7,250 sq. ft.	5,850 sq. ft.	4,110 sq. ft.
Area per indicated horsepower............	.453 sq. ft.	.366 sq. ft.	.257 sq. ft.
Fuel consumption in pounds per indicated horsepower per hour			
At full power............	1.6 lbs.	1.0 lbs.	.6 lbs.
At about one-fourth full power............	1,66 lbs.	1.15 lbs.	.75 lbs.

* Includes water in boilers.
† Includes water in jackets, and piping, but not coal in producers.
‡ Includes water in jackets and piping.

The steam-driven battleship, proceeded Mr. McKechnie, was fitted with four 12-in., four 10-in., and twelve 6-in. guns—the most effective combination of ordnance in any warship up to 1905. In the suggested ship it had been found possible, without increasing the length or displacement, to introduce five pairs of 12-in. guns, and to carry eighteen quick-firing guns of 4-in. calibre for repelling torpedo attack. Reference to the plan of the machinery and magazine arrangements would establish the advantage of the gas system. Here they had each of the main magazines located immediately under the pair of guns which it was intended to serve. Moreover, there was communication between the various ammunition and shell rooms. This had the important advantage of enabling ammunition to be distributed throughout the ship with the greatest facility all on one level. In the event of any turret being put out of action, the ammunition reserved for the guns in it could be used for other weapons, all being transported below the armored deck. The benefit derived from the abolition of boiler uptakes and funnels was still more marked. It enabled the turrets to be so disposed without increasing the length of the ship as to admit of all the ten guns being fired on either broadside. This more fully realized the demand for "all-round fire" for all guns than was the case in any existing ship. The internal combustion engine installation allowed a much greater range in the gun distribution, and was more adaptable to a reasonable arrangement of magazines than was the case with steam machinery. Moreover, the temperature in the machinery room was lower, and fewer difficulties were involved in the satisfactory heat isolation and ventilation of the adjacent magazines. In comparing the designs it should be kept in mind that the object was to eliminate any other variant than machinery and gun power, although the actual weight of protective material had been increased. The design was not put forward as representing an ideal battleship. In producing a design it was, of course, necessary to give attention to other considerations than that of gun power. Thus, part of the saving of weight and of space could be utilized for decreasing the size of the ship while maintaining the same armament and protection as in the steam-driven battleship. Or the weight saved might be used for increasing speed by fitting more powerful machinery, although in this particular case an increased speed would be more economically realized in association with increased length of hull. The design, however, clearly showed that greater gun power, and a fuller utilization of such offensive power, was possible with the internal combustion engine. The machinery was at a lower level in the ship, and was consequently better protected. As the power per unit of weight of fuel consumed was greater, the radius of action for the same allowance in displacement would be greater.

A LARGE BOILER ORDER.

The Lake Erie Boiler Works, of Buffalo, N. Y., has completed a large boiler contract and in doing so has proved how an inland concern can manufacture for ocean trade. It also shows the importance of the Erie canal as a connecting link with the coast. The boilers were shipped last week via the canal to New York, whence they will be conveyed to their respective destinations on the Atlantic coast.

The contract called for the delivery of the boilers early in July, and the work was not begun until Feb. 1. Twelve of the boilers weigh 50 tons each, tested to carry 180 lbs. of steam. They measure 12 ft., 6 in. diameter, and 12 ft. in length, each having three 42-in. corrugated furnaces. In the same order were three dunkies, 10 ft. diameter and 10 ft. long. Each of the dunkies has two 36-in. corrugated furnaces. These boilers are also tested to 180 lbs., all built under federal regulations.

All the boilers go to Quincy, Mass., where they will be delivered to the Fore River Ship Building Co., which will install them in colliers now building for ocean service. An account of the launching of one of these colliers, the Everett, will be found in the current issue. Much interest was shown in Buffalo in the completion of the order and the loading of the boilers on canal boats. Crowds gathered at the Ohio basin where the loading took place, and the management naturally took a keen interest in the successful completion of the contract.

Two boilers equally large have been built at the same plant which will also go to Quincy for contract No. 144, a large lumber trade boat. These boilers

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are 12 ft. 6 in. diameter and 12 ft. long, tested to 180 lbs. Three others were built for the Eastern Dredging Co., of Boston, each 10 ft. in diameter, 10 ft. long, and tested to 150 lbs. In the same order are two rectangular fire box boilers for ocean tugs. Two boilers are now building for the Great Lakes Engineering Works, Detroit, and will be placed in hull No. 35, which is one of the new ships for the Western Transit Co., of Buffalo. These boilers will be 14 ft. 10 in. diameter and 12 ft. long, tested to 210 lbs. pressure, and having shell plates 1⅝ in. thick, each boiler weighing 60 tons. The Lake Erie Boiler Works, and the Lake Erie Engineering Works, both of Buffalo, are under the same management.

MACHINE FOR SAWING DECK PLANKS.

Messrs. A. Ransome & Co., saw mill engineers, Newark-on-Trent, have just constructed for Sir W. G. Armstrong, Whitworth & Co., Newcastle-on-Tyne, a machine for re-sawing the wide planks of pitch pine, teak, etc., cut from the log by the log band-saw into deck planks of various widths. It will take planks up to 18 in. wide by 4 in. thick, and is fitted with a variable-feed motion, the fastest advance of the timber being as much as 150 ft. per minute, with a return motion of 200 ft. per minute.

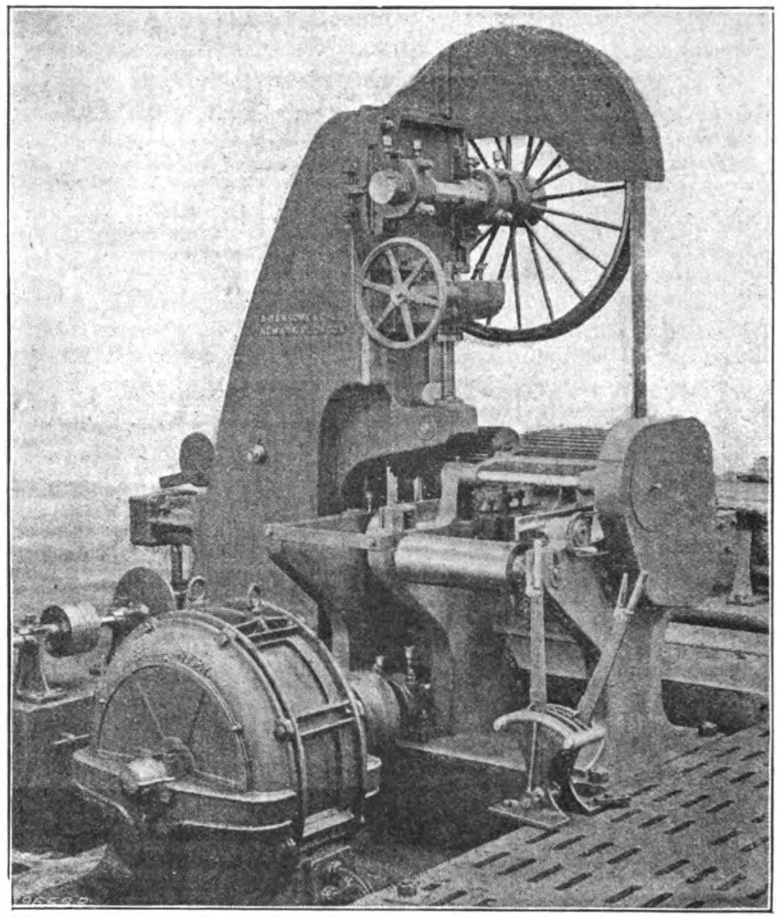

FIG. 2.—BAND-SAW FOR RIPPING DECK PLANKS.

The main standard of the machine is a strong casting of box section bolted to a massive bed-plate, with a large base, which also carries the electric motor for driving the saw, as well as the rollers and gear for feeding the planks up to the saw and returning the plank after each cut. The saw-pulleys, which are 48 in. in diameter by 5 in. wide, are turned on the face, edges, and inside of the rim, and are very accurately balanced to ensure steady running. The top pulley is of special design, the rim and boss being of close-grained cast iron, and the spokes of mild steel, thus combining sufficient lightness with ample strength. The bottom saw-pulley is of cast iron throughout, with a solid web, and is considerably heavier than the top pulley, so as to prevent the saw from over-running in the cut, thus ensuring true work. Both pulleys are mounted on axles of a special quality of forged steel running in long swivel bearings lined with white metal, and fitted with efficient means of lubrication. The bottom saw-pulley is keyed direct to the shaft of a 40 H. P. motor running at a speed of 572 revolutions a minute, thus giving the cutting edge of the saw a speed of about 7,000 ft. per minute. The vertical slide, which carries the top saw-pulley bearings, is adjustable vertically, to enable the machine to work saws of different lengths, and slides on faces planed on the main standard. The vertical adjustment is effected by means of a hand-wheel, and strong square threaded screw, actuated by a worm and worm-wheel. The bearing carriage is hinged on the side nearest to the saw-pulley, to allow of the pulley being slightly canted, thus making it possible to run the saw-blade in any desired position on the face of the pulley. This adjustment is effected by means of two set-screws tightened on to either side of a lug cast on the slide. The required tension is given to the saw by a weight acting on the base of the vertical raising-screw. This weight can be seen to the back of column in Fig. 1. The saw-blade is supported above and below the cut in guides of hard wood, the brackets which carry the guides being attached to the front standard of the feed-gear, and both the

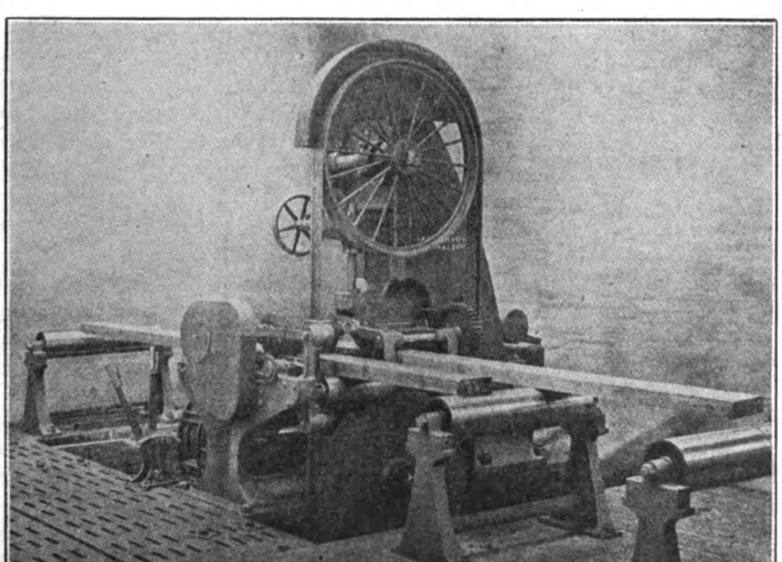

FIG. 1.—BAND-SAW FOR RIPPING DECK PLANKS.

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guides being hinged on pins, so that they can be turned out of the way when it is necessary to change the saw.

The machine is fitted with an improved instantaneously variable friction feed driven from the bottom saw-pulley spindle by a belt, so that if the speed of the saw is checked from any cause, the rate of feed will be decreased in exactly corresponding proportion. The feed-gear is controlled by a lever placed in a convenient position for the operator. The feed ranges from 20 ft. up to 150 ft. a minute, including all intermediate speeds. The countershaft, to which the friction-disc is attached, is fitted with fast and loose pulleys and belt-shifting gear, so that the feed can be stopped without stopping the machine. The variation in the rate of feed is obtained by means of a leather friction-disc sliding on a vertical spindle, and working against the face of a turned cast-iron friction-disc, the feed being increased or decreased as the vertical disc is shifted relatively to the centre of the cast-iron driving-disc. The discs are kept in contact with each other by a strong spring.

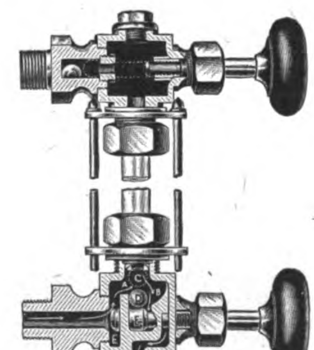
The feed mechanism is very powerful, and consists of a pair of cast-iron rollers 10 in. in diameter by 18 in. wide, both of which are driven by powerful gearing with machine-cut teeth. The top roller is carried on hinged arms, to which a weight is attached to give the required pressure. A stop-screw is provided to allow of the rollers being adjusted to the proper height to suit various thicknesses of wood, and to prevent their dropping too low when the last plank has been fed through. The top roller is fluted to give an extra grip on the wood, and the gear wheels which drive the rollers are actuated by a worm and worm-wheel running in a dust-proof oil-box. The feed-rollers are fitted with a fence, which can be very quickly shifted for any width up to 5 in. by means of two quick-threaded screws connected with a chain, and worked by a hand-wheel placed in a convenient position for the operator. The quick-return motion consists of two cast-iron turned rollers, 10 in. in diameter by 15 in. wide, both of which are driven by the same gear-wheels which drive the feed-rollers, but intermediate gearing is provided at the end of the feed-spindles to rotate the rollers in the contrary direction to that of the feed-rollers. This at the same time gives them an accelerated speed of one-third faster than the feed, so that at whatever rate the material is being sawn, the planks will always be returned at a somewhat faster speed. The return rollers are fitted with a fence on one side, so arranged that the material is always kept against the fence, and thus long pieces are prevented from running off the rollers. Ten independent cast-iron standards and rollers are provided, five of which are fixed on the floor to carry the timber on each side of the machine, each standard being fitted with two rollers, one for supporting the material as it is being fed up to the saw, and the other for carrying it when being returned.

The two levers controlling the motions for stopping and starting the feed, and regulating the rate of feed, are carried in a switch-rack placed in the front of the machine, in the most convenient position for the operator.

A HIGH-CLASS AUTOMATIC WATER GAGE.

The "Success" automatic water gage has many good points, several of which are of vital importance to users of water gages. For instance, its automatic devices will not stick or become corroded. The automatic balls *must* go to seat when glass breaks. Blow-off is operated by gage handle and seats of valve can be reground. No other gage has these features.

The objections to many automatic gages are that the automatic devices go to their seats on the sudden opening or closing of blow-off or they become corroded, stick fast and do not operate at the critical moment. An examination of the "Success" gage will convince any engineer that these two objections are entirely overcome as will be seen from the following explanation.



SECTIONAL VIEW OF "SUCCESS" WATER GAGE.

"E" is a double-seated valve to close both the gage and the blow-off. It will be seen, therefore, that every time the lower handle is turned to blow-off the gage the automatic device or ball "D" is moved by the stem on which it rests. In addition to this the stem follows the course of the arrows "B" to the outlet "G," creating a *downward* pressure on the ball "D" and rolling it about in the chamber in which it is located. This great agitation of this ball from three to six times a day prevents it from ever becoming limed up and stuck fast. When the glass breaks everything is reversed; the steam rushes upward to the break, creating a strong vacuum at the lower end of glass, when ball "D" is instantaneously raised to the location marked "C," when flow of steam ceases. The upper ball is forced to its seat by pressure from boiler. The double seats of valve "E" can be ground by simply loosening the stuffing nut on handle.

The Penberthy Injector Co., of Detroit, Mich., who manufacture the "Success" and a large line of water gages stand behind all claims they make for them.

FALLS HOLLOW STAYBOLT IRON.

The Falls Hollow Stay Bolt Co., Cuyahoga Falls, O., are erecting a new mill of three times the capacity of its present plant to take care of its rapidly increasing trade for Falls hollow and solid stay bolt iron from the railways and boiler makers in the United States, Canada, Mexico and foreign countries. The company has recently issued a circular claiming safety and economy for its staybolt iron as follows:

By the equilibration of the temperature between the inner and outer sheets of the firebox, expansion and contraction of the staybolts are made equal and uniform.

The breakage of the staybolts is reduced to the limit of the life of the material in wear and tear, unaffected by dilatations, which produce crystallization.

The natural life of good material is increased and its tensile endurance in the steam space is 15 per cent greater in temperatures up to 500 Fahrenheit.

The breakages at the critical temperature, and breakages at higher temperatures, in the inner ends and necks of the staybolts are often causes of explosions.

The brittle quality is never, when the material is good, found in temperatures under 500 Fahrenheit.

The steam, after absorbing the excess heat in the inner ends, disrupting, in part, by dissociating its hydrogen and oxygen, superheated to a perfect gas, passes with those gases into the furnace, there converting the solid fuel into a gaseous fuel, and to water gas.

At the same time, with the making of the gases, the streamlets of air passing through the staybolts, take with them the heat at the inner ends of the staybolts, and there, in the presence of the sensible heat of the furnace, and in the affinity of its oxygen for the combustibles in the fuel, the oxygen separates from the nitrogen, (which improves the draught) to unite with the combustibles in the gaseous fuel, and perfects combustion by their perfect union.

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